SPECIAL: THE IMPROVEMENT OF CITIES DISCUSSED BY THE AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS

Vol. XXIII. November, 1902. No. 5.

MUNICIPAL ENGINEERING

A MONTHLY MAGAZINE

DEVOTED TO THE IMPROVEMENT OF CITIES

PAVING, SEWERAGE, WATERWORKS,
STREET LIGHTING, PARKS, STREET CLEANING,
GARBAGE DISPOSAL, PUBLIC SANITATION, BRIDGES.

PUBLISHED BY
MUNICIPAL ENGINEERING COMPANY
INDIANAPOLIS AND NEW YORK.

Two Dollars Per Year. Single Copies, 25 Cents.

The Best Pavement Today is Warren's Bituminous Macadam

ITS WEARING SURFACE IS

STONE

INSTEAD OF

SAND

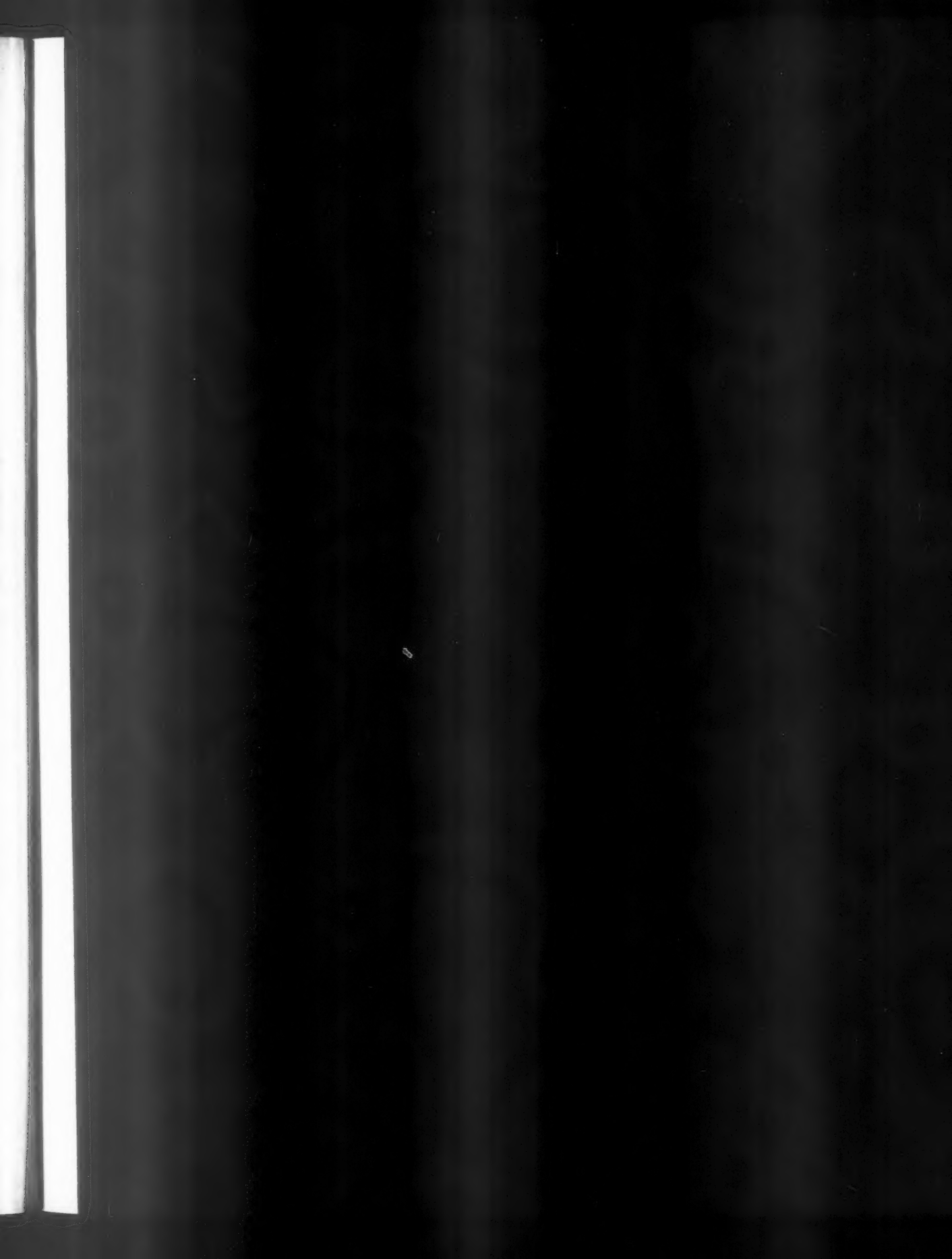
CITY OFFICIALS & PROPERTY OWNERS HAVE EXAMINED THIS PAVEMENT UNDER TRAFFIC & PRONOUNCED IT

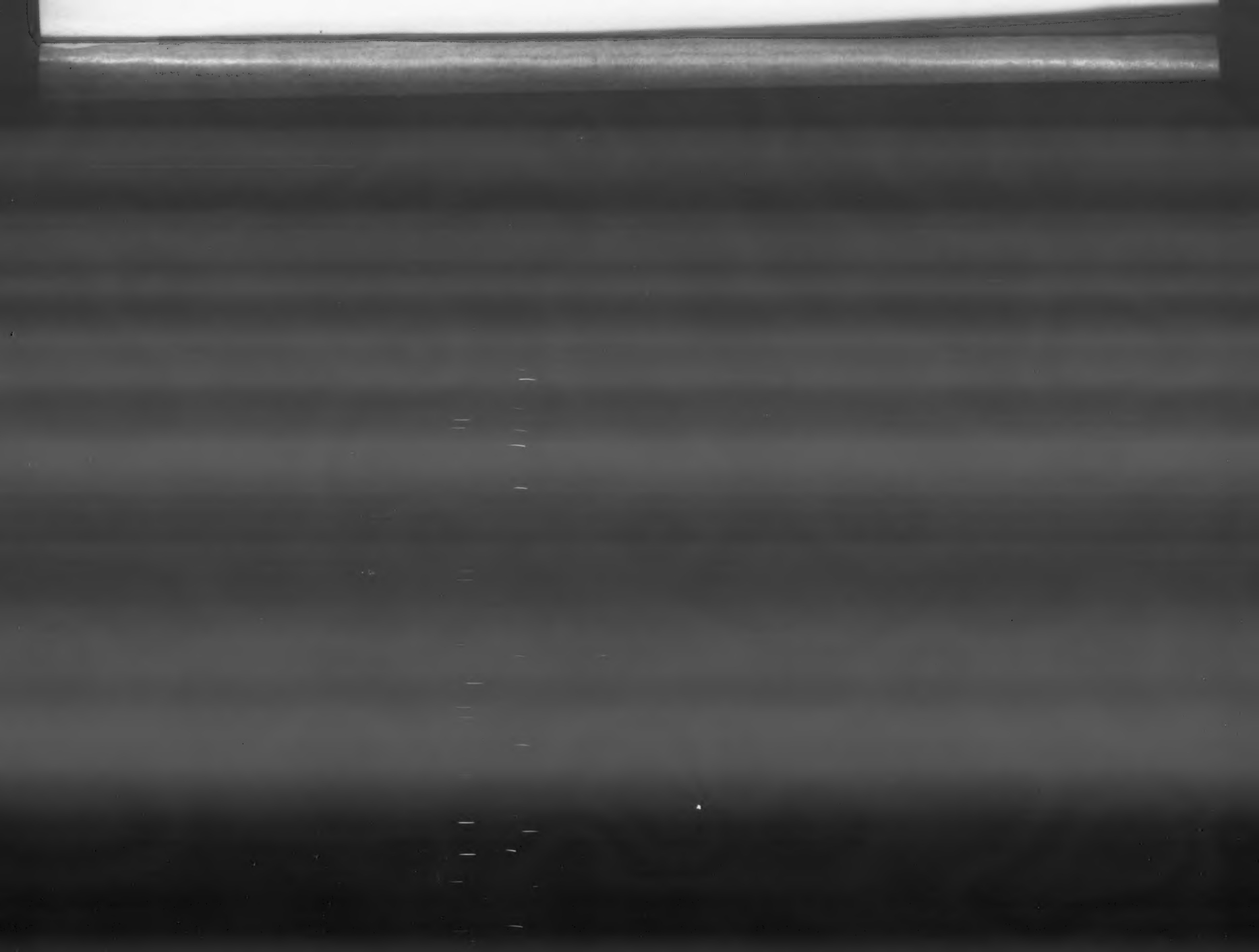
THE BEST FORM of STREET CONSTRUCTION

YET DEVISED. ¶ WE CAN SEND YOU COPIES of THEIR RECOMMENDATIONS AND INVITE YOUR INSPECTION

WARREN BROTHERS COMPANY

Executive Offices: Postal Telegraph Building, New York
Operating Offices: 93 Federal Street, Boston





Municipal Engineering

VOLUME XXIII. NOVEMBER, NINETEEN HUNDRED TWO. NUMBER 5.

IMPROVEMENT OF CITIES.

THE NINTH ANNUAL CONVENTION OF AMERICAN SOCIETY OF MUNICIPAL IMPROVEMENTS.

The ninth annual convention of the American Society of Municipal Improvements, held at Rochester, N. Y., October 7, 8 and 9, 1902, was one of the most successful in the history of the society in the character of the members present, the interest in the meetings and the completeness of the arrangements for the edification and the entertainment of the attendants. Much of this is due to the untiring efforts of the president, Mr. E. A. Fisher, the city engineer of Rochester, and his able and willing assistants in the municipal service and among the citizens. While it seems almost too much to ask of a president to have the local management of the convention as well as the preparation of the program, the plan was certainly a success at this meeting. Other conventions have had perhaps more papers of the highest order, and still others have had more spirited and valuable discussions of the questions presented for consideration, but for continued interest and close attendance of delegates at the meetings, as well as for interest of the citizens not directly connected with municipal affairs, there has not been its equal in the history of the society. A short sketch of the principal events of the various sessions will be given, followed by the papers presented as fully as our space will permit, retaining everything of the first value.

On Tuesday morning, October 7, a large proportion of the delegates arrived, and the meeting of the executive committee was notable from the fact that every officer of the convention was present and two of the past presidents. The finances of the society were reported to be in good condition, with over $160 in the treasury, a material increase over the previous report. A proposition for the appointment of retiring President Fisher as a member of a joint committee of several improvement societies to consider the holding of a joint convention at St. Louis in 1904, as outlined in the president's address, was discussed, and after later reference to the society and return to the committee, was postponed with the recommendation that no such step be taken this year.

At the afternoon session, Mayor A. J. Rodenbeck delivered an address of welcome, an abstract of which will be found on a following page. Vice-President G. M. Ballard, of Newark, N. J., responded with thanks for the reception and treatment of the delegates, and congratulations upon the beauty of the city. After the consideration of a number of applications for membership, the president's address was delivered. The reports of the secretary and treasurer were received and the regular program was proceeded with.

The first paper, according to the usual custom, was the report of the committee on uniformity in municipal accounting and on national statistics, which was presented by the chairman, Charles Carroll Brown, of Indianapolis. In accordance with the recommendations of the report the forms for water-works reports of the New England Water-Works Association, the additional forms for occasional reports recommended by the committee, and the forms for paving and sewerage reports were adopted and recommended for use by cities in making annual reports. The forms for reporting parks, street railways, garbage, street cleaning and street lighting statistics, presented for the first time in this report, were held over until the next convention. A resolution was passed continuing the committee for another year and instructing it to confer with the department of labor and other national bureaus col-

lecting similar statistics regarding the adoption of forms by them which will not conflict with those adopted by this society. The text of the report of the committee is given on a following page, the forms being omitted for the present.

C. H. RUST, CITY ENGINEER, TORONTO, ONT.
President-elect, A. S. M. I.

Robert E. McMath, chairman of the committee on municipal franchises, was not present, and Mr. W. S. Crandall, of New York City, the member of the committee having the report in charge, did not present it, nor did he present his own paper upon the subject which had a place on the program. Mr. McMath's valuable report is given almost in full herewith, and the following is an abstract of Mr. Crandall's remarks:

A letter to the mayors of 135 cities of 30,000 population or more, regarding compensation paid for franchises by public corporations, brought replies from 53. Of these no compensation is received by Birmingham, Ala., Bridgeport, Conn., Wilmington, Del., Quincy, Ill., Dubuque, Ia., Portland, Me., Fitchburg, Salem and Somerville, Mass., Grand Rapids, Mich., St. Paul, Minn., St. Joseph, Mo., Bayonne and Trenton, N. J., Schenectady and Troy, N. Y., Toledo, O., Portland, Ore., Charleston, S. C., Chattanooga, Tenn., Houston, Texas. Many others receive nothing more than a small percentage of a small state tax, an annual license of $5 to $10 on each street car or a small tax on poles. Gas, electric light and telephone companies are usually exempt from taxation, and the street railroads oftenest pay such taxes. One telephone company in Portland, Ore., is to pay $1,000 a year, a license of $200, and free service to city offices and fire department.

Seattle, Wash., has a franchise inspector, who collects 2 per cent. on gross receipts of all public corporations, except gas companies, realizing about $15,000 a year. Elizabeth, N. J., collects from its less important street car line $100 a mile of street occupied till 1905, thence 3 per cent. of its gross receipts for five years, and 5 per cent. for the remainder of the franchise period, not less than $250 a mile, besides paving from curb to curb, repairing for three feet outside rails, sprinkling and removing snow. Telephone companies pay $100 a mile a year for use of not less than ten miles of subway, with certain free telephones and free subway space.

York, Pa., requires from heating companies 1 per cent. of gross earnings, increasing at end of three years to 2, another three years to 2½, another four years to 3 per cent., and will raise the tax to 10 per cent. if controlling interest is sold to non-residents. The street railway pays $100 license for rolling stock, $100 for use of streets and fifty cents a pole per year.

VICE-PRES. A. P. FOLWELL, C. E., EASTON, PA.

In Providence, R. I., street railways pay 5 per cent., telephone companies 3 per cent.,

CONCRETE STEEL ARCH, GRAND RAPIDS MICH., SHOWING CENTERING.

electric light companies 5 per cent., gas companies 3 per cent. of gross earnings.

Peoria, Ill., will receive about $6,000 a year from street railways for remainder of franchise period.

Greater New York received in 1901 $413,890 from percentages on gross receipts and car licenses, receiving nothing from telegraph and telephone companies. Chicago receives percentages from railway, electric light, telegraph and telephone companies. St. Louis received $205,055 in 1901 from railways, telephone, telegraph, electric light and others, except gas companies. Cincinnati receives 5 per cent. of gross earnings of street railways and a license for cars of 1

VICE-PRES. E. D. LOGSDON, B. P. W., INDIANAPOLIS, IND.

per cent. of gross earnings. Other companies pay nothing but ordinary taxes. In Cleveland two gas companies only pay 10 per cent. on gross receipts. St. Paul, Minn., will receive 5 per cent. on gross earnings under new franchises.

California cities sell franchises to highest bidder, the payment after three years being fixed at 3 per cent. of gross earnings. Mobile sold street railway and light franchise on scale beginning with ¼ of 1 per cent. for first ten years and increasing slowly to 2 per cent. for sixth and following ten-year periods to 1955. In Rochester, N. Y., street railway pays $5 a car per year and 1 per cent. of gross receipts.

The best state systems for taxing public service corporations are those of Massachusetts, New York, New Jersey and Pennsylvania. Systems of merit are found in Ohio, Indiana and Illinois. In Pennsylvania all corporations are subject to a state tax of one-half of 1 per cent. on capital stock, including franchise and earning capacity. In Massachusetts the average rate of taxation is about 1½ per cent. on the aggregate market value of the stock less the real estate locally assessed. Street railways also pay the excess earnings over 8 per cent. on stock, and a tax of 1 to 3 per cent. on gross earnings. In New York street railways pay 1 per cent. on gross receipts, and 3 per cent. on dividends in excess of 4 per cent. on stock, and water, light, power and heat companies pay one-half of 1 per cent. on gross receipts, and 3 per cent. on dividends in excess of 4 per cent. New Jersey corporations pay one-half of 1 per cent. on actual value as determined by a state board. In both New York and New Jersey personal property of public service corporations is assessed for local purposes, not including value of franchise and deducting debts.

The session of Tuesday evening was an interesting feature of the program, being largely devoted to an exposition of the beauties and the engineering works of the city of Rochester, aided by the stereopticon. The water supply, lakes, conduits and reservoirs was treated by John F. Skinner, special assistant engineer; the water distribution and electrical subways by W. N. Radenhurst, water-works assistant engineer; pavements and sewers by W. J. Stewart, first assistant engineer; the street railway system by R. E. Danforth, assistant general manager, and improved electrical conditions in track returns by J. E. Putnam, electrical engineer. Abstracts of these papers are given herewith. J. Y. McClintock, commissioner of public works, gave a running commentary upon a number of views of the city streets and other features, and C. C. Laney, superintendent of parks, gave a simlar talk upon a large number of views of the parks and other scenic features of the city. Other cities in which the society meets will do well to follow the lead of Rochester in this session, giving, with such trips as may be made, a clear and full idea of the city even to those who come entirely unacquainted with it.

The evening closed with the valuable report of the committee on parks and park development, G. A. Parker, of Hartford, Conn., chairman.

Before adjournment the convention passed resolutions upon the death of George A. Hotchkin, superintendent of water-works, which occurred suddenly on the day before the meeting while conferring with the president regarding some of the arrangements. The society recognizes that it has lost a valuable member, and that the city has lost an efficient and painstaking officer. Adjournment was taken to three o'clock on Wednesday afternoon on account of the funeral services.

SEC'Y GEO. W. TILLSON, BUREAU OF HIGHWAYS, BROOKLYN, N. Y.

On Wednesday morning the committee on entertainment furnished tally-ho coaches enough to carry all who wished to see the beauties of the city, and to inspect its engineering features. The ride included the various classes of street pavements, the Mt. Hope reservoir, several of the bridges across the river and canal, glimpses of the water power available, and the handsome residence sections of the city. A few members extended the trip, by trolley, to Charlotte, and others inspected some of the good roads which the state of New York is building in the immediate vicinity of Rochester.

At the afternoon session the report of the committee on sewerage and sanitation was presented by A. P. Folwell, of Easton, Pa., chairman, as given elsewhere. It was followed by papers on "Residential Septic Tanks," by Burton J. Ashley, of Chicago, Ill.; on the "Biological System of Sewage Disposal," by John N. McClintock, of Boston, Mass., and upon "Sewer Maintenance," by John H. Emigh, of North Adams, Mass., abstracts of which appear in their proper order. The report of the committee on disposition of garbage and street cleaning, was presented by John H. Emigh, chairman, who also presented in abstract papers by Ernest Adam, of Newark, N. J., on "Garbage Disposal," and by Dr. David H. Judd, of Boston, Mass., on "Sanitary Science and the Public Health." Mr. Adam's paper was largely made up of a report to the city of Newark upon the local conditions regarding garbage disposal, the specifications upon which bids were called for and some statistics upon the amount and cost of garbage disposal, taken from the report of the department of labor for 1901 upon statistics of cities, which can now be supplemented by the report for 1902, issued in September.

Dr. Judd's paper recognized the services of architects and engineers, biologists and bacteriologists, as co-operators with physicians in their work of preventing disease. He emphasized the value of the biological system of sewage and water purification and commended the principles involved in the apparatus with which he was acquainted. He also called attention to the great services rendered by Professor W. T. Sedgwick in the cause of sanitary science and public health.

The election of officers resulted in the unanimous choice of those selected by the nominating committee:

President, C. H. Rust, city engineer, Toronto, Ont.

First Vice-President, G. M. Ballard, president Board of Public Works, Newark, N. J.

Second Vice-President, A. P. Folwell, consulting engineer, Easton, Pa.

Third Vice-President, Edwin D. Logsdon, member of Board of Public Works, Indianapolis, Ind.

Secretary, George W. Tillson, chief engineer, Bureau of Highways, Brooklyn, N. Y.

Treasurer, F. J. O'Brien, superintendent of public works, Oswego, N. Y.

Finance Committee—Emmet Steece, city engineer, Burlington, Iowa; Fred Giddings, city engineer, Atchison, Kan.; J. M. McCartin, street commissioner, Birmingham, Ala.

Indianapolis was chosen as the place for the next meeting.

It is seldom necessary to make permanent record of the proceedings at a banquet, but the character of the speeches made on Wednesday evening after the excellent entertainment for the inner man require an exception to the rule. The toastmaster, William H. Sutherland, the corporation counsel, is a pastmaster in the art of introducing speakers. Rev. Clarence H. Barbour, upon the subject of "Rocks in the Road," called attention to several obstacles to progress.

One of them is unjust and inequitable revenue production. Nothing stultifies and dishonors our business men as does tax evasion. This thing is a club held over property owners by political influences,

TREAS. F. J. O'BRIEN, SUPT. PUB. WORKS, OSWEGO, N. Y.

threatening that they must face changes in their property valuations if they do not fulfil certain conditions. Instance the relations between the public service corporations and the municipality.

There is an immense amount of exemption and I question the righteousness and the justice of a large part of it. The exemption of church property from taxation is an evil, and an evil which I, for one, will be glad to see come to an end.

If you take the fixing of property valuations out of the hands of politicians you will go far to do away with one great injustice.

It is inevitable that the man elected to city office under the emblem of either national party will be bound to it, and the party organization will see that he does not forget it. I hope for the day—and expect to see it—when no man will be elected to city office under a national party emblem. They can elect a man without his national party emblem in Cambridge, Mass., and we can do it here.

This is the second boulder in the way of municipal progress. A third is the rock of indifference—of selfish citizenship. One of the reasons that people come from the country to the city is that they would shirk individual responsibilities, and the municipality will assume them for them. The city does some things for us, it is true. It gives us police and light and water and sanitary system because we can not spare time to do those for ourselves as individuals. But that does not relieve us from our duties as citizens, and the man who does not interest himself in municipal matters is not a good citizen.

Mr. G. A. Parker, of Hartford, Conn., having visited the parks of Rochester, used them as a text for a plea for the completion of park systems and their adaptation to the modern requirements, that they may compete successfully with private and street railway parks, which have so many objectionable adjuncts.

William W. Armstrong, state senator from a Rochester district and the father of the present good roads law of the state, under the title of "Underground Work," put in vigorous language some valuable suggestions regarding treatment of elections and elective officers, from which we make liberal extracts elsewhere.

Other entertaining and instructive addresses were made by Nelson P. Lewis, chief engineer of the board of estimate and apportionment of New York, giving graphic pictures of the growth of the city and the vast sums spent in new improvements and in repairs; by L. P. Ross, of the Rochester Chamber of Commerce, on "Municipal Improvements and Business," and by Mayor A. J. Rodenbeck on the subject of "Rochester."

The Rochester Chamber of Commerce and its committee on entertainment set a standard for this convention function which it will be difficult for other cities to reach.

The morning session on Thursday was devoted mainly to street lighting and water supply, including a report of the committee on electric street lighting, by Charles H. Rust, of Toronto, Ont., chairman; a paper on "Electric Street Lighting," by Alex

CONCRETE-STEEL ARCH, GRAND RAPIDS, MICH. DETAIL OF CENTERING.

Dow, of Detroit, Mich.; one on "Electrical Government," by Austin S. Hatch, of Detroit, Mich.

The report of the committee on water-works and water supply, by George H. Benzenberg, of Milwaukee, Wis., and Morris R. Sherrerd, of Newark, N. J., called attention to the principal discussions in water-works associations. One of the most important of these is water purification, the discussions of which show that no general recommendation can be attempted at this time. The New England Water-Works Association has adopted standard specifications for water pipes which the committee recommends to this society for consideration, especially in regard to a modification of the specifications for cleaning pipe and for character of coating. The time has come for requirement of a much smoother interior surface of pipe, possibly to be se-

G. H. BENZENBERG, C. E., MILWAUKEE, WIS.

cured by a vitrified coating, improving efficiency as well as acting as a permanent protection.

The report was followed by a paper on "State Water Supply in New York," by George W. Rafter, of Rochester.

The paper by Mr. George A. Hotchkin, which was upon the program, was not presented on account of his sudden death, but it will be printed in the proceedings of the convention.

Mr. J. W. Howard read his paper on "How to Minimize the Injury to Pavements by Water."

The afternoon session was devoted to roads and pavements. The report of the committee on street paving, by N. P. Lewis, of New York, chairman, served as an introduction to a paper by Edward A. Bond, New York state engineer and surveyor, on the "Work of the New York Highway Commission;" an extemporaneous talk upon the "Work of the Massachusetts Highway Commission," by W. E. McClintock, of Boston, its chairman, and papers on "Roads and Street Improvements," by Emmet Steece, city engineer, Burlington, Ia.; "The Development of the Bituminous Macadam Pavement," by Fred J. Warren, of Boston, Mass., and "The Use of Wood Pavement Under Heavy Traffic," by F. A. Kummer, New York city. The discussion over these papers was quite spirited and in marked contrast to the lack of discussion upon other subjects during the convention. Much of it was upon details of the papers, but two points were brought out which were not touched upon in papers or reports. One of these was the use of oil on roads. Mr. J. M. McCartin, street commissioner of Birmingham, Ala., reported an unsuccessful experiment, and loud complaints from drivers over the road of injury to clothing and to paint of vehicles. Mr. W. E. McClintock gave an account of the use of oil on a sandy road on Cape Cod, and said:

"I have an idea that there should be from a half inch to an inch of dust on the road to make the plan of laying it by the use of oil successful. I understand that the oil used in the west is of an asphaltic nature and that in those dry climates a covering is produced over the road which resembles asphalt pavement. The sprinkling of roads with oil does not work well in a wet climate.

"We made the experiment on a certain piece of road in Massachusetts, but with very unsatisfactory results. We did not heat the oil, as I understand is done in the west, and I do not think we had the same kind of oil used there. The farmers claimed that the tires of their wagons were ruined by driving on the road after it had been treated. Whenever the paste formed struck the varnish on the buggies it left a mark, and it spoiled clothing whenever it came in contact with it. In three months there was slight evidence of the treatment, but in a year one could not tell that it had ever been used. The oil also injured the road-bed by working into the stones and loosening them."

Another point was the report upon the action of wooden block pavements in Indianapolis by Charles Carroll Brown, in answer to a question. The irregular swelling of the blocks when wet was described. It occurs in blocks of all kinds, whether treated or not, but is not particularly noticeable in the creosoted blocks until the third year after they are laid. The pavement rises in

larger or smaller areas and ridges, and blocks must be split or taken out entirely in relaying the disturbed pavement, to the injury of appearance. Attention was also called to the shrinkage of blocks in cold weather, and subsequent swelling after a thaw, as described in vol. xxii, p. 154, of MUNICIPAL ENGINEERING.

After more than usually enthusiastic adoption of the resolutions of thanks for the favors received from the entertainers of the society, adjournment to Indianapolis next year was taken.

A small party was taken over some of the good roads in the vicinity, completed and under construction, on Thursday morning, and other members were provided by the state engineer's force with facilities for a similar trip on Friday morning. A steam launch of the department was also put at the disposal of members for a trip on the canal.

The number of ladies accompanying members was quite large, and special entertainment was given them during business sessions of the convention in the form of carriage and trolley ride to the lake, and seats in the theaters. Nothing was left undone which would add to the comfort and pleasure of the visitors, and the convention was quite as successful in a social way as in the transaction of its business, without the least interference in interest or effect upon attendance at meetings.

The registry of attendance follows. As usual, many failed to put their names upon the book:

Albany, N. Y.—E. A. Bond, state engineer; William Pierson Judson, deputy state engineer.

Allegheny, Pa.—J. J. Cochran, superintendent of highways; D. L. Fulton, director of public works; G. C. Langenheim, city engineer.

Atchison, Kan.—Fred Giddings, city engineer.

Boston, Mass.—J. N. McClintock, civil engineer; W. E. McClintock, chairman state highway commission; Fred J. Warren, of Warren Brothers Company.

Birmingham, Ala.—Julian Kendrick, city engineer, J. M. McCartin, street commissioner.

Brooklyn, N. Y.—C. D. Pollock, assistant engineer, bureau of highways; James H. Strain, 440 First street; George W. Tillson, chief engineer, bureau of highways.

Buffalo, N. Y.—E. W. McCray, Buffalo-Pitts Company.

Burlington, Iowa.—Emmet Steece, city engineer.

Cleveland, Ohio.—George M. Pierce.

Easton, Pa.—A. Prescott Folwell, cons. engineer.

Elmira, N. Y.—Leon D. Conkling, city engineer.

Erie, Pa.—B. E. Briggs, city engineer.

Grand Rapids, Mich.—L. W. Anderson, city engineer; Edgar S. Kiefer, board of public works; John Rowson, board of public works.

Hartford, Conn.—G. A. Parker, superintendent Keny Park.

Indianapolis, Ind.—Chas. Carroll Brown, cons. engineer, editor MUNICIPAL ENGINEERING; Edwin D. Logsdon, Board of Public Works; James B. Nelson, city engineer.

Milwaukee, Wis.—George H. Benzenberg, cons. engineer.

Montreal, Can.—John R. Barlow, city engineer; Alcide Chaussé, inspector of buildings.

Nashua, N. H.—Edward J. Johnson, city engineer.

Newark, N. J.—George M. Ballard, president Board of Public Works; C. V. Baumann, chairman of water commission; Augustus F. Eggers, Board of Public Works; W. C. Garrison, chairman of street commission, William E. Greathead, secretary Board of Public Works; J. Crowell Mundy, general superintendent of works; M. R. Sherrerd, engineer and superintendent water department; J. B. Stobaeus, Board of Public Works; Joseph S. Vinson, chairman of sewer commission.

New York City—W. S. Crandall; J. W. Howard, cons. engineer; F. A. Kummer, C. E., 29 Broadway; Nelson P. Lewis, chief engineer, Board of Estimate and Apportionment.

North Adams, Mass.—J. H. Emigh, city engineer.

Oswego, N. Y.—F. J. O'Brien, superintendent public works.

Ottawa, Can.—N. J. Kerr, city engineer.

Rochester, N. Y.—E. A. Fisher, city engineer; J. Y. McClintock, commisioner of public works; Thomas Neville, deputy commissioner; J. E. Putnam, cons. elect. engineer; W. N. Radenhurst, water-works asst. engineer; George W. Rafter, cons. engineer; John F. Skinner, special water-works asst. engineer; William J. Stewart, first asst. engineer.

Toronto, Ont.—James Crane, Board of Control; John Jones, supt. streets; C.

H. Rust, city engineer; James W. Somers, asst. city clerk; F. H. Woods, chairman committee on works.

Washington, D. C.—D. E. McComb, supt. sewers; Captain H. C. Newcomer, asst. to engineer commissioner.

Williamsport, Pa.—Frederick Snyder, city engineer.

Wilmington, Del.—Harvey J. Wiley, clerk of Board of Public Works.

The papers presented are given on the following pages, as fully as space permits, arranged according to subjects and very nearly in the order in which they were read.

ADDRESS OF WELCOME.

Mayor A. J. Rodenbeck.

This convention is of special interest to the people of this city because you have assembled for the purpose of discussing questions of municipal improvements, in which every good citizen is concerned. We will take unusual interest in your deliberations and we are especially gratified at your coming.

But aside from the joint interest which we feel with you in the questions which have brought you here we are gratified also by the fact that you have honored our city by the selection as the president of your organization of one who has served this city impartially and so faithfully that he deserves the commendation and has received the approval of all our people without regard to party. He was connected with the city when its second water conduit was built and its large trunk sewers constructed, and not a little of the excellent condition of municipal improvements in Rochester is due to the effectual and painstaking labors of the quiet and unassuming gentleman who is the president of your organization and who presides over the engineering department of our city government—Mr. Edwin A. Fisher.

Rochester has afforded an excellent field for municipal development. It is the third city in the state in population and is surrounded by as rich an agricultural section as can be found in the country. It is easily the first in many manufacturing enterprises, and is distinguished for its educational and benevolent institutions. In fire losses it compares favorably with any city of its size, which fact attests the efficiency of its fire department. In the personnel of its police department it is equal to any, and it is hoped to bring this department up to the highest standard of efficiency. It is one of the best-lighted cities in the union. It has a park system appropriately located on the banks of the Genesee river, furnishing recreation for all its people. The location of the city, its pure water, its good sewerage and the general condition of its streets has made it the healthiest city in the state. Numerous railroads afford connection with the outside world. The Genesee river, which divides the city into almost equal parts, has been the silver band along which the city has clustered and furnishes water power which can be disposed of as cheaply as that in any other city in the United States. All of these advantages are afforded to our people at a tax rate which compares favorably with that of any other city of its size.

MAYOR A. J. RODENBECK, ROCHESTER, N. Y.

This is the Rochester of today. There are problems now confronting the city which if properly worked out mean a wonderful development for the city. While it is the immediate province of the engineers and officers performing similar functions to discharge the ordinary duties connected with the performance of municipal work, there are greater questions before every community relating to its development and advancement which it is the function and duty of these offi-

CONCRETE-STEEL ARCH, GRAND RAPIDS, MICH., COMPLETED.

cers to call to the attention of the community. Here in Rochester we are interested in the great problem of developing the water power of the Genesee river by the construction of regulating reservoirs which will give an equable flow of water during the dry season and marvelously increase the water power of that stream. The river within the boundaries o. the city falls 260 feet, which statement alone to an engineer will convey an impression of the possibilities in this direction. If the enormous quantity of water that comes down this stream in the spring of the year can be harnessed and made to turn the wheels of industries, an enormous advantage would be derived by the city. Related to this subject is that of deep water ways across the state. If the national government impelled by the demands of the western farmers for an outlet for their products from the great lakes to the Atlantic should construct a suitable canal through the state substantially along the line of the existing Erie canal, a tremendous impetus would be given to the growth of the city and the development of its industries. These are the problems which it is the duty of the engineering experts to exploit, for their full comprehension is beyond the grasp of the unskilled mind.

PRESIDENT'S ANNUAL ADDRESS.

By Edwin A. Fisher, Rochester, N. Y.

In opening this, our ninth annual convention, it seems to me appropriate to briefly consider a few questions relating to the future of the society.

First—Is a society of mutual improvements necessary or desirable? One of our past presidents has truly said that if it is thought that cities can or ought to adopt the principles which prevail in private corporations, or to follow the methods which are used by those whose main purpose is to make money, the proposition is wrong fundamentally.

We may, however, in the interest of efficient and economical construction and maintenance of municipal improvements learn a lesson from the business management of our large transportation systems. The officers of these corporations. from the presidents to the section fore men, have associations for mutual improvement in each special line of work These associations or societies hold regular meetings or conventions, which are well supported and well attended. Each association or society considers even the minutest details of the work coming under the supervision of its members, and while all the associations work for the general good of the corporations they represent, each confines itself to its particular line of study or work. The phenomenal success of our railways, excelling those of any other country in every respect, is due very largely to the work of these associations.

The electric railway has also reached its highest development in this country. With a population of 70,000,000 we have over 21,000 miles of track, while the whole of Europe with its population of over 350,000,000, has less than one-fourth of this amount. The electric railways have come into use almost wholly in the past twelve years; and while, on account of limited experience, they are yet behind the steam railways in details of construction, maintenance and efficiency of service, their progress has been even more marked. They, too, recognize the necessity of association. During the present week the Street Railway Association of America is holding its annual session in Detroit. This association is amply supported by the street railways of America, and its annual conventions are well attended and of the greatest interest and benefit to the members. In addition to the national association the states have societies and associations of similar character.

Instances of the necessity of organized effort in other lines of enterprise might be multiplied. The illustrations cited, however, are sufficient to show the value which our largest and most successful private industries place upon organizations for the mutual benefit of their managers and other officials; and also that these managers and other officials avail themselves of the ample opportunities offered for gaining additional knowledge from the experience of men in similar occupation.

The municipal officers of American cities control and supervise expenditures exceeding those of any one private industry, excepting only that of steam railways. The expenditures of 212 cities for the year 1898 were estimated by Mr. N. P. Lewis, ex-president of this society, in his annual address at Toronto, as follows:

For improvement and care of streets, about	$50,000,000
For water supply	35,000,000
For sewerage	14,000,000
For public lighting and public buildings	27,000,000
For parks and bridges	22,000,000
Making a total of	$146,000,000

exclusive of police, fire protection and

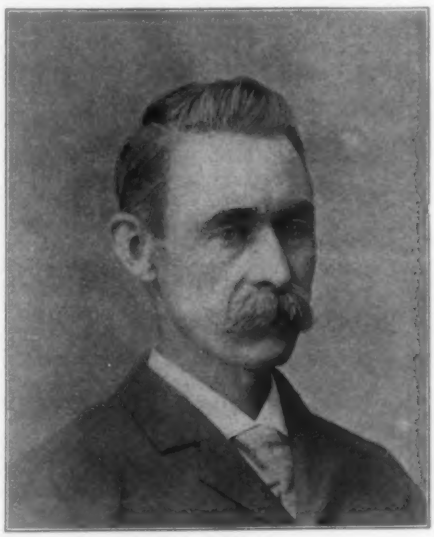
other items of municipal expenditure. He sums up by saying that the total expenditure in the 212 cities referred to would have been nearly $535,000,000. An examination of the United States bulletins of the department of labor issued since the new census of 1900, shows that these figures were rather an under estimate than over estimate. The United States Bulletin of Labor for September, 1900, gives the total amount of street paving in 129 cities having a population of 30,000, as more than 300,000,000 square yards, or the equivalent of about 19,000 miles of pavement 27 feet in width. Of streets unpaved the yardage given for the same cities is 420,000,000 or the equivalent of about 26,500 miles of streets 27 feet in width.

Mr. M. N. Baker, associate editor of Engineering News, in his municipal year book for the year 1902, states that there are in this country 1,524 cities and villages of over 3,000 inhabitants; 457 of 10,000 or over; 295 of 15,000 or over; 135 of 30,000 or over, and 38 of 100,000 or over. The men in control of the expenditures in these cities are in the main getting good service and doing creditable work. There is, however, a lack of uniformity of method and of standards for similar work under like conditions that make the annual reports of little value for purposes of comparison. It is the purpose of this and kindred associations to correct this defect and to bring about a better and more uniform practice. There is, therefore, need of associations like ours in the field of municipal work.

That this society is not supported by the municipalities interested as it ought to be, and that the officials of these municipalities do not take the interest in the society that officials of private corporations do in societies for their mutual advantage, is a self-evident fact. Taking into account the large number of cities in this country and the vast amount of work done, a society like this should have a membership many times larger than it has at present, and its annual conventions be much more liberally attended.

Second—Is the society doing the work for which it was organized? The object of the society, as expressed by its constitution, is to disseminate information and experience upon, and to promote the best methods to be employed in the management of municipal departments and in the construction of municipal work, by means of annual conventions, papers and discussions, by social intercourse, and to circulate, by means of an annual publication, the information thus obtained.

Mr. McMath, in his address at Niagara Falls last year, gave a resume of the work done up to that time. Including the papers presented last year, there has been read before the various conventions, and printed in the "Proceedings," a total of 152 papers and reports; 49 upon street paving and related topics, 22 upon sewerage and sanitation, 18 upon water works and water supply, 17 upon disposal of garbage and street cleaning, 7 upon street lighting and the balance upon miscellaneous subjects coming under the various committees of the society. Mr. Lewis, in his address at Toronto in 1899, said with reference to these papers and reports: "The printed reports of our conventions contain



E. A. FISHER, CITY ENGINEER, ROCHESTER, N. Y. Ex-President, A. S. M. I.

probably the most valuable collection of papers on municipal works which are published in any one volume," and suggests that the high character of this publication should be maintained.

The work of the society at present is divided into eleven subdivisions, under the following heads: Street paving, electric street lighting, sewerage and sanitation, disposition of garbage and street cleaning, water works and water supply, municipal data, park development and maintenance, taxation and assessment, city government and legislation, municipal franchises and review.

So far as I am aware there is no national society or association except this one that considers the subject of street paving, sewerage and sanitation, and disposition of garbage and street cleaning.

In the matter of electric street lighting, the International Association of Munici-

pal Electricians also takes up this subject, as do the various societies connected with the private electric corporations in the country. In the matter of water works and water supply, the American Water Works association has for a number of years maintained a very successful national organization dealing with this subject. There are also several associations more or less local, among which are the New England Water Works association and the Central States Water Works association, both of which have done excellent work in this field.

In the matter of taxation and assessment this society has had eight papers and reports. Taken altogether they are the most valuable contribution to this important subject that has been offered anywhere. I know of no other society that has made a specialty of this subject.

In the matter of city government and legislation we have had five interesting and valuable papers. It seems to me, however, that for the future this subject might in the main be left to the consideration of the League of American Municipalities, as it is a subject which it seems to be is more appropriate to a society made up largely from the legislative departments, than to a society of executive municipal officers.

In the matter of municipal franchises, we have had one paper previous to this meeting, and have now a valuable contribution in the form of a report from our former president, Robert E. McMath of St. Louis. This branch it seems to me may also be, perhaps, better left to the League of American Municipalities.

In the matter of park development and maintenance, there is a number of associations dealing with this subject, the most prominent probably being the American Park and Outdoor Art association.

In the matter of municipal data and statistics, a large number of societies are dealing with this same subject, and it is one in which all are interested.

This society has, during the nine years of its existence, adhered closely to the practical program laid down in its original constitution. It has done valuable work in a field heretofore unoccupied. It has accomplished much in securing a greater uniformity in the specifications now in use by cities in its membership, and also in the forms of their annual reports. It has by reports of committees and original papers presented and discussed at its annual conventions disseminated a vast amount of information in the various details of municipal work, which has resulted in better and more economical work in the same cities. It has been my privilege to attend six of the annual conventions of this society as a delegate from this city, and I can therefore speak from a personal knowledge of the influence of its work. A number of honored and loyal members who, notwithstanding the vicissitudes of American politics, have been with the society since its inception, have publicly corroborated these views of the work of the society.

Did the cities of America realize the value of associations as do the great private corporations, membership in this society and attendance upon its meetings would be a part of the official duty of the executive officers in charge of public work or service

Our friends interested in municipal work as contractors, contractors' agents, or dealers in municipal supplies, eligible to membership under sec. 3, art. 2, of our constitution, will find in our annual convention the best opportunity to meet with representatives of boards of public works, city engineers and others having charge of municipal work. They may take part in discussions and enjoy all the rights and privileges of full membership, excepting that of holding office or voting. Additional membership in this class will be to the mutual advantage of both the members and the associates.

As to the future of this society the words of Robert Moore, president of the American Society of Civil Engineers, in his excellent address at the convention in Washington, relative to the future of that society, will as well apply to ours. He said that in the years to come it will be a more potent factor in the advancement of knowledge and promotion of high professional standards, is something which we cannot doubt. That it will do this in part by the intellectual stimulus of its papers and discussions. But more important than the intellectual stimulus of its papers will be the moral stimulus of the personal contact and acquaintance made possible by our meetings. It is in fact hard to overestimate the value of such reunions in quickening the interest of those who take part in them. Nothing is so vitalizing as the meeting of those of like sympathies in common pursuits. Scattered, the embers die out; in contact, they burst into flame.

PORTLAND CEMENT CONCRETE PAVEMENT, GRAND RAPIDS, MICH.

REPORT OF THE SPECIAL COMMITTEE ON UNIFORMITY IN MUNICIPAL ACCOUNTING AND ON NATIONAL STATISTICS.

Charles Carroll Brown, Chairman, Indianapolis, Ind.

The committee on uniformity in municipal accounting and on national statistics desires to present a report of progress and some recommendations for immediate action with reasons for believing that definite action upon certain propositions will advance most rapidly the cause for which this committee and the society have been working for several years.

At the time of the last meeting of this society several societies were making special efforts to bring about uniformity in accounts and reports in various lines of municipal activity. The American Municipal league has adopted forms for the financial reports of cities which present the operations of the various departments as wholes and give the balance sheets of the city. Other societies have been working upon the forms for keeping the detailed accounts and making the reports of the departments from which the summaries in the league's forms are taken.

The New England Water Works Association has somewhat modified and combined its schedules and adopted them in the new form. These schedules include summaries of local conditions of water supply, pumping in amount and cost, financial statements of receipts and expenditures for maintenance and construction, table of assets, data regarding mains and service pipes, population and consumption.

The American Water Works Association has adopted the forms of the New England association; so has the Central States Water Works association.

The other societies mentioned in the last report of this committee have done little or nothing during the year.

All the societies have shown their tendencies to consider the branches of the subject which are of particular interest to them, and to leave action upon other subjects to the societies composed of experts in those lines. Out of the collection of adoptions by the various societies any interested city department or company can select the forms needed for its use and thus fall into uniformity with other similar departments. On account of the disinclination to take up any but the subjects in which the society is directly interested, there has been no conflict, and there is but one set of forms having the authority of adoption, if there is any.

For these reasons, and to extend the number of adopted forms to cover the activities in which this society is interested, the committee earnestly recommends the adoption of the forms presented in the appendix to this report. With the exception of rather unimportant modifications in the water works schedule, they have been before the society for a number of years and have been printed twice in its proceedings. Opportunity for discussion and amendment has been given at each meeting of the society and no changes have been suggested. The society is, therefore, as well prepared to take action at this time as it is likely to be.

The first form recommended for adoption as an encouragement to uniformity in municipal accounting, by requiring uniformity in annual reports, is that for water works systems. The form of the New England Water Works Association has now the authority of adoption by three associations, though some small modifications in form have been made in one society since the adoption by the others. So far as this form extends it agrees with the forms proposed by this committee, and, for the sake of agreement with the societies of experts in this department we recommend the adoption by this convention of the form of summary of statistics in annual reports adopted by the New England Water Works Association at its last meeting given in appendix A. There is one class of information which is not given by this report, that concerning details of new construction and cost, including stand pipes, filters, settling basins, wells, pumps, pipes, etc. These are included under the heading of general statistics and cost of pipe laying in the forms presented heretofore by this committee. We suggest the recommendation of the forms presented in appendix B for these reports when they are to be made. They include the items in schedules 1 and 9 of the report of this committee on pages 43 and 48, proceedings of 1900. Another matter not covered by the New England association is the comparison of statistics. To make comparisons from year to year with that association's form it is necessary to have all the annual reports at hand. Some water departments desire to make these comparisons each year. When they are

desired we suggest the recommendation of the forms presented in appendix C. They include the items not already provided for in schedules 2, 3, 6, 7, 8, 13 on pages 44, 47 and 50 of the proceedings for 1900.

No other association has recommended or discussed forms of street reports, or of sewer reports. We recommend the adoption by this convention of the forms in appendices D and E of this report, which are the same heretofore presented by this committee and printed on pages 52-58, proceedings of 1900.

The collection of statistics by the various departments of Washington seems now to be without system. The census being taken but once in ten years, much of its data are not taken often enough to satisfy the needs of the departments and the demand of the public for information. The various departments collect information with little or not reference to the work done in this line by others and it is apparently given sometimes into the hands of clerks who are not sufficiently familiar with the subject of the inquiry to make out proper question blanks. The adoption of the forms herewith presented and the recommendation of them to the departments, will be efforts in the right direction. These forms are prepared by experts and should serve as guides to the department clerks in preparing their question blanks, not using every item, perhaps, but following the approved forms in their blanks and thus aiding in the pull for uniformity in reports and accounts, where it does not now exist, and insuring proper answers to the questions where the approved forms are in use.

The Bulletin of the Department of Labor for September, 1902, contains the latest collection of Municipal Statistics. In some respects they are on forms very similar to those recommended in this report, and where there are differences they are not very material, but the forms herewith are considered preferable. The number of items on which information is given in the Bulletin is materially less than in the committee's forms of the same kind, but the Bulletin has forms covering many other departments of the cities' activities. The annual collection of municipal statistics has expanded each year, somewhat, and it is believed that much assistance in the cause of uniformity can be rendered by this department if its co-operation in the lines of effort in this society can be obtained. A central bureau of statistics which will concentrate all this class of work in one office is to be desired, but until it can be established the present system must be looked to for the desired assistance. The Department of Labor is under the guidance of experts in statistics, and its work is of the highest order attainable at the present state of progress. Co-operation of the department and of the societies interested in the work it is studying should be easy to secure. The committee therefore recommends the appointment of a committee to consider this matter of co-operation with the national bureaus and especially with the Bureau of Labor, with instructions to communicate with the heads of such bureaus and consider ways and means of unifying the work of the cities and the methods in which the bureaus can aid in this work.

Some forms in the Labor Bureau's report properly belong to the province of this society, but they have not heretofore been presented in this committee's reports, because it had no member expert in these lines and has had no response to its appeals for assistance. Appendix F contains these forms with one or two additions which are deemed desirable, and they are suggested for consideration and adoption with the other recommended forms if found satisfactory. They are not directly recommended by the committee for adoption because they have not been before the society as the others have, and have therefore not had the opportunity for consideration and criticism. That they are the forms of the Department of Labor is certainly high recommendation for them. They include parks, street railways, street cleaning, garbage collection and disposal and street lamps.

MUNICIPAL FRANCHISES.

By Robert E. McMath, Consulting Engineer, St. Louis, Mo.

An important function of government in civilized countries is to promote the welfare of the people by providing means and instrumentalities to facilitate the movement of persons and things, to encourage traffic and exchange. When men collect in considerable numbers at any locality wants are developed in great variety, both individual and such as are common to all. On the theory that each considerable community is best able to know its wants, its resources and the

wishes of its members, the sovereign power delegates to a local organization the right of home rule as to certain things. Such organizations may take various forms, but they may be classed under the general name of municipalities. A municipality is the creation of the sovereign power and has no natural or inherent rights or powers. It is the agent and can only do what is ordered or permitted by the creator. The supreme court of the United States said: "A municipal corporation is a subordinate branch of the domestic government of the state. It is instituted for public purposes only, and has none of the peculiar qualities and characteristics of a trading corporation instituted for the purpose of private gain, except that of acting in a corporate capacity." The sovereign power grants franchises of municipalities. But there is a secondary class of franchises granted by the state to be exercised in cities, or granted by cities under the powers delegated to them by the state, and especially the latter. A municipal franchise is of the nature of a contract and as such is inviolable. Therefore, every provision of a proposed franchise should be carefully studied as to practical and legal features by competent persons on the part of the municipality. Too often the draft of ordinances is made by attorneys of the party seeking the franchise and is one-sided.

It is sometimes difficult to find a distinction between what in a popular sense are contracts and those called franchises. A city, for instance, lets a contract to pave a street and maintain it for a term of years; if as payment it gave the contractor the right to collect tolls from the users of the street the contract would be a franchise, but if it makes payment by the issue of special tax bills, to be collected by the contractor, it is a simple contract, even if the payment is divided into installments and not complete until the end of the specified term. The real difference lies in the fact that in the latter case the amount to be paid is definite, in the former indefinite. The holder of a franchise takes chances of gain or loss, a contractor receives a definite sum.

The right of a natural person to engage in any business or avocation, or of several persons to combine as a firm to do business, is in many cases subject to limitations, such as requiring evidence of fitness as a condition of receiving a license. Every one who complies with the conditions is entitled to a license. A license is not a franchise. A number of persons associate as a corporation. If they must obtain the special authority of the sovereign they receive a franchise. A king giving to a favorite some privilege in trade other than his fellows have, grants a franchise. If a privilege extends to a class that class is enfranchised.

The giving of a franchise is a sovereign act, given or withheld at pleasure. The franchise giving power in some states been taken from the legislatures by constitutional provisions prohibiting the enactment of local or special laws, "regulating the affairs of counties, cities, townships, wards and school districts," "creating corporations or amending, renewing or explaining the charter thereof," "granting to any corporation, association or individual any special or exclusive right, privilege or immunity, or to any corporation, association or individual the right to lay down a railroad track." (Constitution of Missouri, Art. iv, sec. 53.) The writer has been unable to find in the constitution or statutes of Missouri specific authority given to cities of any class to grant franchises, except for steam and street railways. Numerous franchises have been given for other purposes, under the general authority to regulate and control the use of streets and public places incident to police powers. There is no other foundation for such acts. Probably the same is the case in other states.

The reason for granting franchises is found in the ever growing need for public services of many kinds, as cities increase in population, expand into new territory and develop new wants. Some of these needs are met by the cities direct. Corporate and financial powers permitting, the meeting of others is farmed out under franchise grants. If a public service cannot be made to return a revenue in excess of cost, municipal ownership and operation go without question. But if it can be made profitable, then municipal ownership and operation become objectionable to some.

It is difficult to find a natural distinction between unprofitable and profitable public services; restore and expand the fee system and such as are now rendered at public expense, will become profitable. We are thus thrown back upon corporate and financial powers for decision whether the city may itself, render a service or not. The opinion of the United States supreme ccurt, by plain interpretation, is not favorable to operation of public utilities by cities for profit, unless the power is expressly given by the city's charter to do that thing and charge for the service. A certain large city constructed a railroad, several miles in length, and operated is as an adjunct to water works

to transport materials, supplies and employes to its water pumping station. It was proposed, in answer to popular demand for a public service, to use the tracks and equipment for the conveyance of passengers and to collect fares; but it was found that the city could not operate a railroad for gain, though it could so operate water works. The same city might grant to a railway corporation the use of the road and receive rent.

A municipality may grant the right to use streets, highways and public places for specified purposes, which must be of public nature, but the grantee must be one authorized to carry on the business. Often this condition requires the grantee to be a corporation. The use of streets cannot be given for a private purpose but there must be a public service open to all who wish to use it, and the ordinary use of a street must not be prevented.

Since space under, on and over streets is limited, the privilege to use space is of value, and the value will increase enormously as the city grows. As a consequence of space and time limits privileges become practically exclusive, even though the grant may in terms be not exclusive. Taking for illustration a street railway franchise. The limited width of streets will prevent, in most cases duplication by independent tracks, twin tracks produce as much interference as would result from joint use of tracks by independent companies, and joint use is limited by the necessary time interval between trains. In case the right to use an existing road is given and the conditions fixed by contract or court proceedings, in the course of time the increase of business will render the arrangement impracticable, the service will be unsatisfactory and consolidation of interests wil surely result. The subject of a franchise is therefore a natural monopoly.

Municipal franchises, in theory at least, have as the prominent idea a service to the public of sufficient importance to warrant the occupancy and use of parts of streets which belong to the public, such occupancy and use being subservient to use by the public and adjacent property for ordinary and accustomed purposes.

The functions of city authorities are divided into two classes, legislative and executive. Giving of franchises is a legislative act because it is discretionary; therefore, the power should be given the legislative division. As a consequence of abuses some advocate making franchise grants subject to approval by the people, others that the legislature be forbidden to name the beneficiary, the franchise to be sold in the open market. All concur that safeguards against corruption are needed. All that have been proposed are objectionable, as cumbersome and probably impracticable.

The effective remedy is to put the safeguard where it will stop the corrupter. If there be fraud, let the taint of fraud be on the thing obtained, and be there to stay. The taint on corrupter or corrupted will soon be put away by the act of oblivion for evil deeds called the statute of limitations, but if the taint attach to the thing the incentive to use of unscrupulous measures will be removed.

An imagined case will illustrate how things are done, discover the real villains and show that the remedy here proposed is the only effective one. The idea occurs to some master mind that by con-

ROBERT E. McMATH, C. E., ST. LOUIS, MO.

solidating partially rival street railway interests, great profits may be made, but consent of the municipality must be obtained and a club provided to drive the owners of existing roads into the combine, or compel them to sell. The idea when put in shape strikes a few men who command money as a sure good thing, but they know that, as things are, such such a scheme cannot be gotten through the legislative body innocently, and they do not propose to procure the needed legislation, for that would be very wrong, but if some one else should procure the desired franchise, it might be purchased for a reasonable price and the innocent purchaser be wholly ignorant as to how it was obtained. A fund is then made up and placed in safe hands. Next it is rumored that if a franchise such as is desired should happen to be for sale, a purchaser with the cash is ready to buy. A franchise measure is soon proposed granting to a new corporation, having a

trifling capital, large privileges to build, lease or purchase and operate an extensive railway system. The new work proposed parallels some old lines and avoids others. The old heads recognize the finger marks and know what the thing means, and either fight or favor the measure. Corrupt legislators are in clover, bids for votes run high, some who have stood out against small temptations yield when offered a small fortune for a single word and finally the big thing is authorized. The infant corporation then sells its rights, receives its purchase price, pays off its debts, redeems its promises, distributes its assets, and goes out of existence. Rumors of bribery may be current, some men may be uncommonly flush, and everybody knows but none can prove what has been done. The innocent purchasers of the franchise have not lifted a hand, do not know a thing, have only purchased what their attorneys advised them was a valid franchise, which was offered for sale at a reasonable price. Next a new corporation is organized which persuades or induces owners of old roads to sell their holdings and the thing is done, beyond possibility of recall or successful attack.

All this is possible because the law, courts and lawyers have brought into existence a fictitious personage whom they call the Innocent Purchaser, whose title to his purchase may not be questioned.

The purchaser of real estate must see to it that he gets a clear title as well as possession, and why not apply the same principle and make franchises void if procured corruptly. The writer does not propose the confiscation of property, only making void the ill-gotten franchise, and turning the matter back for a new adjustment.

When a public service is needed it may for a time be unprofitable, therefore it is not just to require large payments for privileges, nor to fix a sum at first with arbitrary increase with years. It would be well to look at a public utility as a business enterprise, to which the public contributes the use of streets. At first the contribution may have no money value. Though essential to the business it is not part of the capital invested, but is rather a contingent interest dependent upon the general growth and prosperity of the city. The best measure we have of general growth and prosperity is found in real estate values, and the value of the use of a street under a franchise may be taken to be in proportion to the sum of real estate values on the street, and a varying rental may be estimated on such values.

The conditions of a franchise for a public service cannot be fixed in advance of experience. As needs develop the service must adapt itself to changes. The municipality should retain the right to regulate the service and it should provide a competent oversight and an impartial tribunal to decide disputes with power to enforce its decisions, so that the service may be good and uninterrupted.

THE WATER SUPPLY OF ROCHESTER, N. Y.

John F. Skinner, Special Assistant Engineer.

Nearly 50 years ago the mayor of Rochester, in his inaugural address, said: "It is to be hoped that our citizens will soon feel the necessity of supplying our city with water by some means, both for their health and convenience."

In 1860 $500 was appropriated for "the survey and plans for water works" in accordance with which Daniel Marsh submitted a report embodying five distinct plans, viz.:

1. By elevating water from Lake Ontario by steam power.
2. By elevating water from the Genesee river at the Rapids south of the city.
3. By collecting the rainfall upon the sources of Little Black creek into a reservoir near its mouth, conducting it thence to a point at or near the rapids and then elevating it by pumping.
4. By taking water from the outlet of Honeoye lake, near Smithtown, Monroe county in a 20-inch pipe to a receiving reservoir.
5. By taking water directly from Hemlock lake in a 16-inch pipe to a distributing reservoir.

The Mendon ponds were also exploited as a possible source of supply.

The water works committee advertised for proposals according to plans 4 and 5 and the Rochester Water Company did considerable work in building reservoirs and laying conduit and distribution pipes, but collapsed early in 1872.

In 1873 the board of water commissioners was organized and work on the present system was begun, taking its supply from Hemlock lake, a clear sheet

of water 6½ miles long, little more than half a mile wide and 86 feet deep, lying between high hills about 30 miles south of Rochester and having 43 square miles of watershed. The city has also acquired the right to use the waters of Canadice lake, 86 feet deep, about one-third the area of Hemlock lake, and 200 feet higher, with nearly 14 square miles of watershed. The annual precipitation for the last 26 years has been 27.90 inches. This, with a run-off of 40 per cent., will give an available yield of about 32,000,000 gallons per day, if provision is made to store 9 feet of water in Hemlock lake and 5 feet in Canadice lake.

Hemlock water is brought to the city by gravity through two conduits. No. 1

J. F. SKINNER, C. E.,
Rochester, N. Y.

was laid in 1873-76 and consists of cast iron pipe and wrought iron pipe with lead joints. For 10 miles from the lake to Factory Hollow overflow it is 36 inches in diameter; from this point for 10 miles further, to the storage reservoir at Rush, it is 24 inches in diameter and laid to a steeper grade; from Rush reservoir to the distributing reservoir in Highland park, a distance of about 9 miles, it is 24 inches in diameter.

Conduit No. 2 was constructed in 1893-94. It starts with an intake pipe extending 1,500 feet into the lake. This pipe is 5 feet in diameter, built in 100-foot lengths of riveted steel and joined above water by flexible joints. The lengths were floated into place on pontoons and lowered into position in the dredged channel from pile platforms.

The water, after passing through screens and gates in the gate house, and over a measuring weir, enters a brick tunnel 6 feet in diameter, built on a grade of one in 4,000. This masonry section, 12,000 feet long, is mainly in rock, and is at some points 75 feet below the surface.

Twelve thousand feet from the lake, at Overflow No. 1, the pipe conduit begins. It is 38 inches in diameter and composed of steel plates with riveted joints, through which it flows to Rush reservoir. From Rush reservoir to the city the conduits occupy opposite sides of the highway for about half the distance, Conduit No. 2 then diverges to the east to facilitate connecting with a proposed reservoir on Cobb's hill.

The intake pipe and the tunnel are made of sufficient capacity to feed two lines of pipe, against the time when the entire yield of the watershed will be required.

Conduit I at present delivers about six and one-half million gallons into the storage reservoir and about eight million into the distributing reservoir. Conduit II discharges sixteen million gallons at Rush and can deliver nineteen million to the city. Were permanent full-sized reservoir connections in use, these figures, for Conduit II., would be increased about 20 per cent.

The Rush storage reservoir, nine miles from the city, is constructed in fill and excavation on a clay hill, the slopes are lined with riprap and the basin has a capacity of sixty-one million gallons at sixteen feet depth. The distributing reservoir, at a depth of fifteen feet holds twenty-two and one-half million gallons. It is built on a sand hill, puddle lined, the lower half of the slopes riprapped and the upper half paved. About half of the present supply is aerated by passing through a fountain. Another distributing reservoir is projected on Cobb's Hill with a capacity of seventy million gallons.

This larger storage near the city becomes necessary as the daily consumption increases. Previous to the completion of Conduit II., there was a shortage of water. Since that time the consumption has steadily increased about half a million gallons per year, from 9,819,000 in 1895 to about fourteen million at the present time. During this period the population has shown an average increase of 2,226 per year, so that it may be said that the daily consumption of water in the city increases 225 gallons as each new citizen comes to town. The per capita has increased about two gallons each year since the construction of Conduit II. The consumption varies during the year, being highest in February during cold weather and generally still higher during the hot months, July and August.

The variation in the rate of consumption, even under normal conditions, has been shown by continuous observations at the reservoir during the week of July 8 to 14, 1900. The rate drops to fifty gallons per head during the night, from midnight to 5 in the morning, then rises rapidly, passing the average, 80.6 gallons, at about 6:30, and reaches the maximum at about 8 o'clock. There is a sharp depression during the noon hour when work is suspended, but the curve rises again at 1 o'clock when operations begin and then falls off gradually late in the afternoon, passing the average between 7 and 8 p. m. and falling to the minimum at midnight. The habit of the people can be seen to some extent from this curve. A similar curve for New York City indicates that its business is not so completely suspended at noon. Here we see the maximum use, on Monday morning, the general washday, and the minimum daily use on the rest days, Sunday and Saturday afternoon. It also shows that dinner on Sunday comes two hours later than on week days.

Chemical and biological examinations of the water, made weekly, show that as a pure, clear beverage, it is beyond reproach.

DISTRIBUTING SYSTEM OF THE ROCHESTER WATER-WORKS.

W. N. Radenhurst, Water Works Assistant Engineer.

Rochester enjoys the privilege of a double system of water supply namely: The use of the water of the Genesee river by direct pumpage into the mains and a gravity system from a mountain lake.

The city contracted with the Holly Manufacturing Company of Lockport, N. Y., on Feb. 27, 1873, for the construction and erection of machinery for a pumping station for utilizing the water of the river.

The Hemlock lake or domestic water was let into Mt. Hope, now Highland distributing reservoir, Jan. 23, 1876, and into the city mains soon thereafter.

As the mains for both systems in the same streets were laid in the same trench the axes of the Holly system of pipes were placed sufficiently below the axes of those of the domestic system to permit service pipes from the Holly mains being freely carried under the shell of the domestic mains and also some ten connections termed "flange connections" with a valve in the connecting pipe were made between the two systems so that in case of necessity the water of either system could be turned with the other.

The water of the Genesee river is taken in from Brown's race and is conveyed by flume to a penstock at the bottom of which two turbine wheels of the centennial type, with a capacity of 250 horse power each, operate under a ninety-five-foot head. Two water sets have a pumping capacity of 4,000,000 gallons in twenty-four hours and steam machinery is capable of furnishing 3,000,000 per day, making a total daily capacity of about 7,000,000 gallons.

During 1893 a temporary additional supply of potable water became necessary during the construction of Conduit II of the Hemlock Lake supply. The Rochester Supply Company furnished about 500,000 gallons daily from deep wells in Brighton until Oct. 4, 1894.

Prior to this supply being obtained and owing to the fact that the consumption of water from the Hemlock Lake system at the pressure due to Highland reservoir, was ordinarily greater than the delivery of the old conduit, it was found necessary to artificially reduce the available head in the old 16-inch distributing main. This was accomplished by partially closing the 16-inch stop valves at two points in these mains, thereby increasing somewhat the pressure in the relatively small high districts above the valves, and correspondingly diminishing it throughout the greater part of the municipal area below said points.

The capacity of the new distributing mains laid in anticipation of the completion of the second lake conduit was made by Mr. Kuichling sufficient to supply 25 fire streams in each district of the city in addition to the maximum consumption for other purposes.

The routes were selected so as to avoid streets where expensive pavements had been laid; and as it was not expedient to interrupt the water supply in most of the street where the new pipes were to be laid, the large mains were placed on the opposite side of the street, leaving all hydrants and house connections on the existing smaller mains.

These larger pipes passed under and over the smaller ones at street intersections and are connected by curved special castings and a communicating pipe controlled by a pair of stop valves, so that

if the valve which is ordinarily used in the operation of the works needs repairing the second one can be closed temporarily.

These new distributing mains as laid to date are 36 and 30 inches in diameter and came into use Aug. 16, 1895.

The general cover of the large distributing mains is from 3 to 3½ feet, all others 4½ feet.

Before giving a statement of the extent of the distributing system at date, mention is here made of the detection of a break in a 16-inch main laid under the Genesee river. A strong solution of bipermanganate of potassium was poured into a hydrant situated on a hillside about 1,200 feet from the suspected point of failure and then pressure was applied by opening up a valve east of said hydrant. In a short time the water of the river, which was quite low, with marked velocity, became strongly colored a purplish red for a distance of some ten feet over the pipe line axis; the extent of discoloration was noted, and location generally established. A coffer dam was built, the water pumped out, and a cracked pipe discovered and removed and a sound one substituted.

The average diameter of domestic mains is 9.05 inches. The average diameter of Holly mains is 9.55 inches. The 4-inch pipe formerly laid, which is rapidly being replaced by pipes of large diameter, is now 20 per cent. of the total mileage.

Rochester has at this time an estimated population of about 168,000 inhabitants, covering an area of 11,635 acres, of which 10,328 acres are available for general occupation.

Within this territory there are about 323 miles of streets and alleys, and in them the following miles of distributing mains and numbers of hydrants and stop values:

	Domestic. Miles.	Holly. Miles.	Totals. Miles.
Permanent mains	268.603	19.283	287.886
Temporary mains	4.695	.....	4.695
Laid by state, county and private parties.	1.417	0.240	1.657
Total in city	274.715	19.523	294.238
Private parties outside	0.366	.....	0.366
Grand total	275.081	19.523	294.604

Hydrants	2,659	296	2,955
Valves	2,772	399	3,171
Sprinkling cart hydrants	30	25	55
Drinking troughs for animals	28	.....	28
Taps, about			35,500
	Gals.	Gals.	Gals.
Consumption per cap	80	10	90
Average consumption per diem	13,214,000	1,612,000	14,826,000

The cost of these systems from the retirement of the Board of Water Commissioners up to date is approximately $1,637,500.00.

ELECTRICAL SUBWAYS.

The Bell Telephone Company of Buffalo, the Rochester Gas and Electric Company of Rochester and the Western Union Telegraph Company are the companies who have laid conduits or subways in this city.

These subways are composed mainly of tile ducts laid so that the top of subway is about 2 feet under the pavement, having its center about 2½ feet from the curb line of street. They also have laid 3-inch wrought iron pipes carrying wires from conduits to cable poles, and at points where owing to other underground constructions there is scant room for placing the ordinary tile ducts.

The extent of conduits laid at date are as follows:

	Miles of Conduit.	Miles of Enclosed Tile and Iron Duct.
1. Bell Telephone Co.	22.58	132.07
2. Rochester Gas and Electric Co.	31.75	292.33
3. Western Union Telegraph Co.	0.78	1 50-wire cable
Total	55.11	424.40

The Rochester Gas and Electric Company have also laid this year about 10 miles of gas mains, making a total of about 194 miles at date.

The Rochester Telephone Company have no conduits, placing their underground cables in those of the Rochester Gas and Electric Company. At date this company has placed 64 miles of cables.

They also have strung about 12½ miles of aerial cables on their pole system.

PAVEMENTS OF ROCHESTER, N. Y.

W. J, Stewart, Assistant City Engineer.

We had in Rochester on Jan. 1 of this year 9.17 miles of Medina block stone pavement, 21.7 miles of common Medina stone pavement, 46 miles of asphalt pavement, 7.35 miles of brick pavement, 25.25 miles of macadam pavement, 15.25 miles of gravel pavement, one mile of cobblestone pavement and 0.71 miles of cedar block pavement; making a total of 126.36 miles.

Gravel, common medina and cobble stone are no longer laid. All others, except macadam, are laid on a 6-in. concrete foundation. The Medina sandstone comes from a point about fifty miles west of the city, and the block stone has been laid for the past ten years. The joints are filled with pitch or cement, according to the time the street can be closed to traffic. Expansion joints are provided at the curb and at intervals of about 25 feet and filled with pitch when the pavement is grouted with cement. The joints of brick pavements are treated in the same way. Eight different kinds of brick have been used, as follows: Bloomington, Ill.; Canton-Malvern; Syracuse; Parto Block; Hallwood Block; Hayden Block; Johnsonburg and Hornellsville. The Johnsonburg and Hornellsville are most used on account of their cheapness. The first brick pavements were laid in 1890.

Of the 46 miles of asphalt pavement 27 miles are made with Lake or land Trinidad, 11 miles with Sicilian or German Rock, 6.8 miles with Vulcanite and one mile of Asphalt Block. The Vulcanite is no longer laid, and Asphalt Block is seldom laid on account of the expense. Asphalt pavements were first laid in Rochester in 1895, and the first general repairs were made in 1897, when the cost was 4.2 cents per square yard of surface maintained. The cost since this time has been as follows: 1898, 1:87 cents; 1899, 1.67 cents; 1900, 2.00 cents; 1901, 3.00 cents; and this year it will be about 4.50 cents. Some of our asphalt pavements were laid under a 5-yr. guarantee, and some under a 10-yr. guarantee. Since 1896 all have a 10-yr. guarantee.

Macadam pavements were probably laid here as early as 1850, generally with Telford foundation, though sometimes with a broken stone foundation, entirely with stone from our local quarries, until 1893, when trap rock was first used for the top course, 4 inches in thickness. It is now always used in making Macadam pavements. It is brought from the Palisade quarries on the Rudson river, on the canal, and is generally delivered here in the city for about $1.50 per ton. The total thickness of these pavements is 14 inches. Everything is put underground before the pavement is laid that it is thought will ever be needed in the street, sewer, water and gas to each lot, ducts for wires of all kinds and the old sewer, water and gas pipes examined.

The form of ordinance now in use which allows us to construct the entire pavement in streets with tracks and charge the railway company its share of the cost has resulted in a wonderful improvement in this class of work. This form of ordinance was adopted after the decision of the court of appeals in 1897, that the company should not only maintain, but also construct new pavements wherever required to do so by the city authorities, within the tracks and for two feet outside of the tracks. The method of construction has been with a concrete foundation 12 inches in thickness, extending the entire width of both tracks, in which standard street railway ties are bedded 2 feet from center to center. This concrete foundation extends 5 inches under the ties. Some has been laid with concrete beam construction, and some with old rails for ties, every third tie extending clear across the four tracks.

Where a considerable amount of underground work has been necessary, Portland cement has been substituted for natural cement in making the 6-in. concrete foundation.

THE SEWERAGE OF ROCHESTER, N. Y.

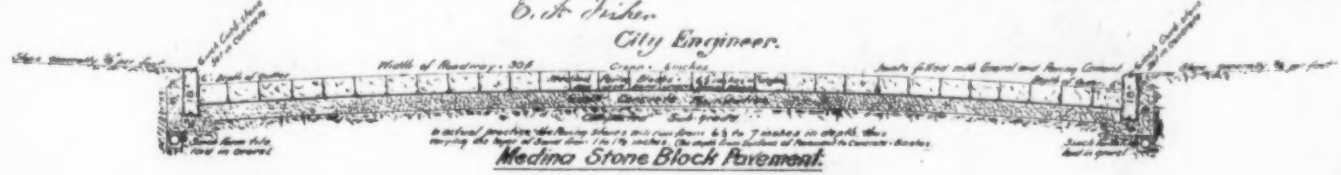
W. J. Stewart, Assistant City Engineer.

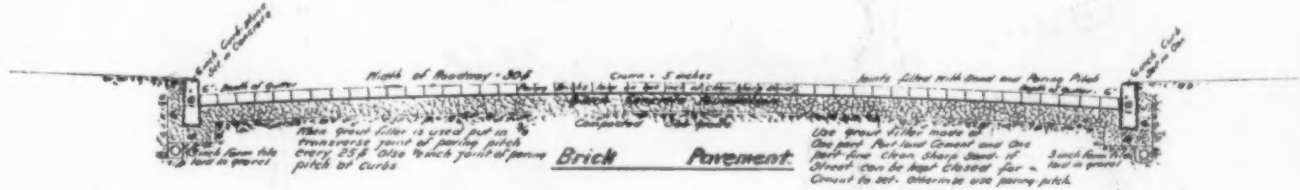
The city is bisected by the Genesee river running from south to north, which receives the entire drainage of the city, consisting of 11,635 acres, through five outlets on the west side and four on the east side of the river.

The river has a fall of 260 feet through the city, the water passing over three falls, ninety, twenty-four and ninety-four feet in hight respectively. From the third or lower falls near the northern city limits to Lake Ontario is about five miles, and the flow in times of low water is as small as 200 cubic feet per second, with a

CROSS-SECTIONS OF ROADWAY IMPROVEMENTS AS CONSTRUCTED IN ROCHESTER, NEW YORK.

E. A. Fisher.
City Engineer.





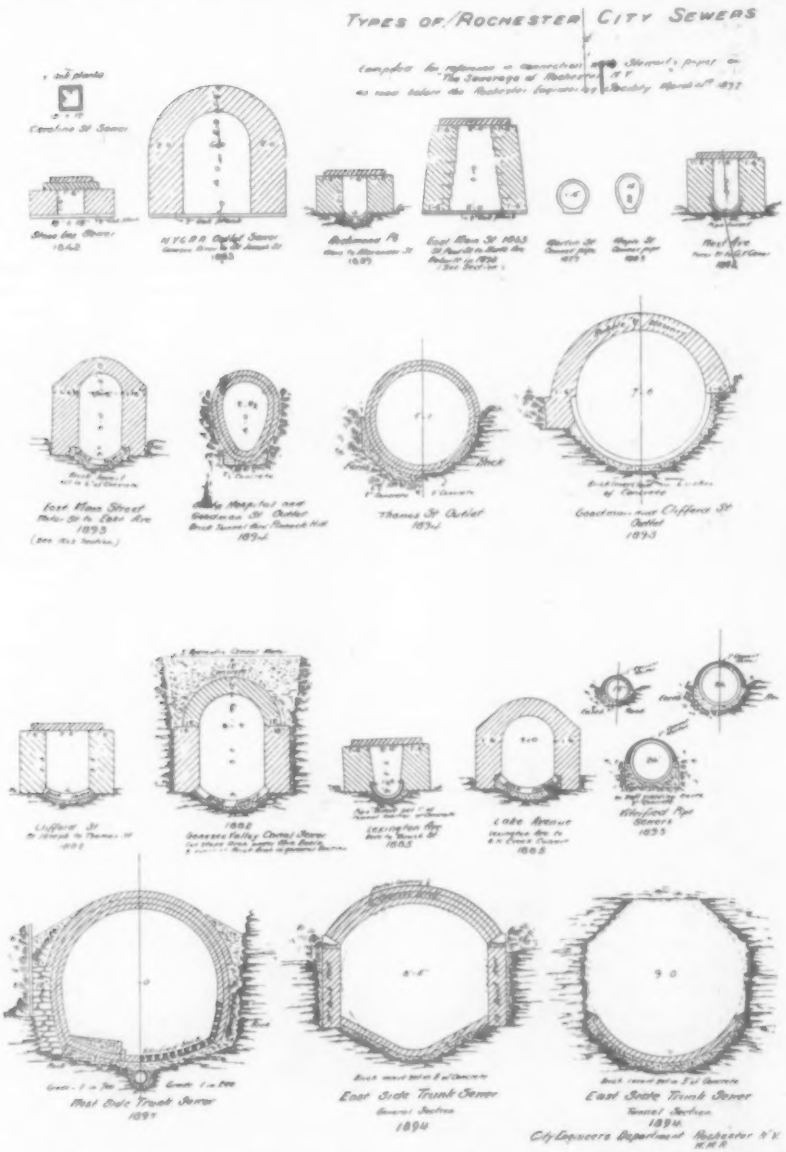
Width of Roadway: 40ft
Width of Roadway: 24ft
Crown: 6 inches
Width of Roadway: 11ft
Asphalt Pavement. Medina Bit in Contracts

Scale: 2 feet per inch.

velocity of less than two miles in twenty-four hours in the lower river. Its maximum flood discharge has been as high as 36,000 cubic feet per second.

The average density of population in Rochester is 16 per acre; its mortality

The rock underlying the entire city, and which is found at depths of from one to fifteen feet below the surface, determined the character of our first sewers, which from 1835 to 1859 were all built of stone. At this time pipe sewers were first laid



14.66 and the average annual rainfall for the past thirty years is 34.82 inches.

On Jan. 1, this year, we had 75 miles of stone sewer, 8.5 miles of brick, 131.5 miles of pipe and one-half mile of wood and iron. Adding the East and West Side trunk sewers we have a total of 228.4 miles.

The most important outlet sewer, and the one serving the most territory, is the one known as the East Side trunk sewer, skirting the eastern and northern boundaries of the city. Its territory comprises over 4,000 acres and it ranges from three to nine feet in diameter and is a little over eight miles in length, the first two miles being in tunnel eight feet in diameter and its discharge through a thirty-

six-inch iron pipe down a nearly vertical river bank 164 feet in hight to a point below the level of the water in the river. It cost, with its overflows, about $1,000,000. Five storm water overflows are contemplated in the design, but only two have been built as yet.

and stone continued to be used for the larger sizes until about ten years ago, when brick was adopted for all sizes over twenty-four inches in diameter. All pipe sewers are now laid in concrete, which allows a much better construction and prevents the entrance of roots through the joints that in time completely fill the pipe. All sewers are laid in perfectly straight lines from manhole to manhole and all junctions are made with curves. In pipe sewers the curves are entirely in the manholes, the inverts being made with half-section junction invert pieces laid the same as the pipe. In sewers that are easily accessible curves are made with ten to fifteen feet radius, with a manhole at one end of the curve. The manholes are placed generally not more than 300 feet apart. Nothing but Portland cement is used.

The topography of the city is so favorable that good grades can generally be obtained, a fall of one in 300 for small sewers being generally obtained and a minimum depth of eight feet for residence streets, though usually a depth of nine or ten feet is obtained. In the business streets we expect to make a minimum depth of twelve feet, and one sewer in Main-st. is from eighteen to twenty-one feet in depth. This latter depth was made so as to allow for the construction of sub-cellars. No flush tanks are used on any of our sewers and no catch basins, all our surface water sewers discharging directly into the main sewers and without traps. These open sewers with the ventilated manhole tops are calculated to ventilate the main sewers, and we have very little complaint about sewer gas, and it is seldom we have to clean a sewer that has become filled. House lateral sewers are always trapped and vented. The entire city is covered by a topographical survey showing elevations of the surface of all streets at their intersections and at intermediate points. Sizes of sewers are computed by the formula devised by Mr. Emil Kuichling when making his elaborate studies for the plans of the East Side trunk sewer, and provides for a runoff of three inches of rainfall in the business section and one inch in the outlying residence section of the city, depending upon the amount of impervious territory, length of sewer and grades.

ROCHESTER STREET RAILWAY.

R. E. Danforth, Assistant General Manager.

In 1862 Rochester boasted of its first horse car, operating over 12.5 miles of street with an equipment of thirty-five cars and seventy-eight horses. In July, 1887, a charter was granted, and in 1889 an electric railway was constructed between the limits of Rochester and Lake Ontario, a distance of four and one-half miles, one of the first in the state and equipped with 10 h. p. motors. The change to electricity in the city took place in 1891 with a power house with 300 h. p. engines, each driving two dynamos of 100 kw. capacity. The railway has gradually increased the size and weight of cars and replaced its light motors with those of latest design so that the standard motor is today 38 h. p. and the standard car thirty-eight feet long, equipped with two to four motors.

In the early days there was prejudice against the location of railway tracks in residence streets and rails were therefore laid along the sides between curb and sidewalk, leaving the driveway unobstructed. Today there are about twenty-four miles of track so located, 25 per cent. of the total mileage.

The early rail for electric service weighed forty to fifty pounds a yard and was placed on cast chairs; now the standards are for block pavement a 9-inch Trilby rail weighing 107 pounds per yard and for brick, asphalt or macadam streets a 7-inch 91-pound rail of similar section.

For several years a concrete foundation has been laid in all repaved streets. Several plans have been tried:

1. Concrete beams without ties.
2. Concrete beams with steel ties spaced at 6-foot intervals with 17-foot connecting ties every 18 feet, the whole bedded in concrete.
3. Concrete beams under the rails and under wooden ties spaced 5 feet apart.
4. Solid concrete 6 to 8 inches deep, under ties spaced 2½ feet, with concrete between the ties and under the base of the rail.
5. Ties spaced 2½ feet on a foundation of crushed stone, with cement between the ties and under the base of the rail.

With the exception of the last method, all are closely allied in point of efficiency, with the third plan in greatest favor of the four on account of ease of

construction and first cost. Concerning this method it may be well to add that excellent results have been obtained where alternate ties were gravel tamped under the centers, the track being surfaced and lined on these ties, and concrete beams, 8x16 inches in section, carried under the rails and all ties, and under the centers of the ties not gravel tamped. In this case, where clay subsoil is found, it is well to carefully drain the subgrade by suitable sewer connections.

Concerning pavement, experience has shown that the most desirable pavement used abutting the rails is of block stone on concrete foundation, closely followed by brick and common stone. Asphalt can not be satisfactorily maintained along street railway tracks. The expansion and contraction of steel and asphalt soon leave a space for water to enter the pavement, which is disturbed by the first frosts. Toothing reduces the evil, but transfers it a few inches away. Rochester specifies on all streets where asphalt is laid block stone or brick between the rails and for two feet outside.

No rail has been designed and rolled which so truly fills the requirements of the railway or which is less liable to disturb the abutting pavement by motion or vibration under load as the "Tee" rail. It is not adapted for general use in streets given over to immense and heavy wagon traffic on account of the increased liability of wetting the abutting pavement. It is, however, well suited to use in all other streets, and lends itself readily to the construction of smooth, unbroken pavements of brick or asphalt and of stone, where the same is carefully cut. It not only carries its load squarely upon its web, but offers no obstruction to the passage of vehicles. As the flangeway is formed on one side by the steel rail and upon the other by the gritty surface of the pavement, wheels readily climb out without being strained, as in an all steel flangeways. Further, the pavement may be laid to the true crown of the street, the narrow head of the rail conforming to the same perfectly. Rochester has had such rail in her streets for years, often indifferently laid, but still showing that properly laid it is neither an eyesore nor a public menace. A grooved rail was never meant for winter climate, as it freezes solid with ice and street soil.

Rochester's tracks are smooth and are perfect return circuits, largely due to a special process of electrically welding the rail joint used the last two years. This process, controlled by the steel trust, consists in mechanically welding under immense pressure and at a welding heat, two bars of 1x3-inch steel to the webs of the abutting rails. By passing 30,000 amperes of current through a point of contact measuring about three square inches, these parts of the bars and rail webs are quickly brought to a welding heat. To obtain the same results as on a blacksmith's anvil, to force the parts together and to maintain the density of the molecules, a pressue of about thirty tons is then applied. As the metal cools and sets the pressure is relaxed and soon removed. The bars vary from 18 to 30 inches, depending on the location and condition of the old bolt holes if any exist. They have at either end an elliptic boss drop-forged across one face, and have a strip of steel 1⅛ by 1 inch placed across the middle of the bar, to furnish the three points of contact at which the welds are to be made. Welds are made first at the center of the bar, over the joint between the ends of the rails, then at the two ends, the entire process occupying about twelve minutes. Before the welds are made the surfaces to be welded are cleaned bright by an air sand blast removing all scale. After the joint is welded the rail heads are ground true with an electrically driven emery grinder, operating on a carriage moving along the rail. When the joint is complete and has been in use a short time it is well nigh impossible, except where old and badly worn tracks have been welded, to find the joints. The joint stands the winter and shows a breakage of less than 1 per cent.

Track switches and special work not being welded, heavy copper cables of equivalent carrying capacity to the rail are carried around such work and the ends electrically welded to the rail with a copper lug.

The Rochester system includes three lines to lake resorts under its management, besides a line running forty miles along the lake ridge to Sodus bay.

One other suburban line is owned by Rochester citizens and connections with cities east and west are in prospect.

IMPROVED ELECTRICAL CONDITIONS.

J. E. Putnam, Electrical Engineer.

Electrolysis is found at points where currents leave one conductor and pass through the earth to another. The point at which the current leaves the pipe or other buried conductor is positive electrically and the corrosive action is due to the liberation of oxygen in its nascent form. It is then of the highest importance to determine, first, the portions of the pipe system which are positive to the rails and, second, to get a value for the intensity of the electrical pressure in that neighborhood. For this reason two years ago a complete survey along the lines of the street railway tracks in this city was undertaken and the conditions were noted. The method of making the observation was to take a volt meter reading to tenths of a volt and connect one pole of it with the rail, the other being connected to the hydrant at the side of the street. Readings at one-half minute intervals are taken for five minutes and the average of these has been plotted on profiles.

The power house is located nearly in the center of the system of tracks so that the outlying ends of the tracks would tend to be positive to the hydrants and the section about the power house to be positive, i. e., the tendency is for the current at the outlying ends to flow into the pipes and in the portion surrounding the power house to leave the pipes to return to the tracks. In this last portion would be found, subject to local modifications, the greatest danger of electrolytic corrosion.

The profiles shown give evidence of great reduction in the differences of pressure in two years, from the measurements in 1900 to those recently made. In one case the polarity is changed. During the two years elapsing between the profiles the Rochester Railway company has been making extensive alterations and improvements on its tracks, not only mechanical improvements as related to the surface of the rails, but also improvements in the conductivity of the rail return. The most marked improvement has in my judgment, been caused by the electric welding of the tracks and the replacing with rails of heavier cross section. In order to determine the approximate amount of improvement in these rail returns I have measured the average drop or loss in voltage due to the resistance of the track return itself. On the Park-ave. line, a distance of 3.2 miles at present, the average drop is 4.9 volts. In 1900 this was 21 volts.

REPORT OF THE COMMITTEE ON PARK DEVELOPMENT AND MAINTENANCE.

G. A. Parker, Chairman, New Haven, Conn.

For the report of this committee I have selected three laws which I believe to be fundamental to all naturalistic park work and have considered somewhat the relationship of parks to cities as to their area, population and wealth, and also their relation to the other municipal functions of the cities' housekeeping. But first I want to emphasize this fact—that park architects and engineers require a special training or peculiar adaptability to become successful in this work, just the same as the water works, sewerage, bridge or railroad engineer requires a special training for success. It is the sound judgment of men who can foresee what ought to be done, the best way to do it, and have done it that makes the expert on sewerage and pavement work, and the park man is made in the same way.

In naturalistic parks the engineer's idea of exactness of detail becomes an offense, for it is not the perfection of detail, mathematically correct, that gives pleasure here. It is the relation, the proportion and correspondence of things. In the field, when the engineer establishes a point he drives a stake, puts in a tack and makes cross lines in its head, but to the park man a point is a quarter of an acre or more. To the engineer a line has length and direction, but to the park man it may be a range of mountains, or a river, or a row of trees, and the landscape line always has width.

The trouble with the engineer seems to be that he wants to put the skeleton on the outside where the turtle has his, but if he does so he produces no higher grade of landscape work than the mud-turtle is among animals. I honor and admire the skill of the engineer. I know only too well its fundamental importance in the

foundation study of parks, but in parks it must be hidden and never seen on the surface.

I have at length discussed this subject because I want it to be realized that there is something beyond engineering and gardening in parks.

It is also many times supposed that expert gardeners make desirable park men. Skilled gardening is desirable in park work, but the skilled gardener is seldom the man to mange the park as a whole, for to acquire his skill he must love plants as individuals while park work is plants used en masse or the relation of a single plant to the composition of the picture as a whole, in which it is only a part. It is not so much the question as

G. A. PARKER,
Superintendent Keny Park, Hartford, Conn.

to what plant is used as to where the plant is located. The gardener loves the tree for its own sake. The park man loves the tree on account of its location, and it is found that the skilled gardener, like the skilled engineer, wants to bring that which he loves best to the foreground for admiration. It may be said that the park man who loves his park picture as a whole is only bringing that which he loves best before the notice of the public, and this is true, but in defense he can say it is the composition as a whole that gives the mental rest, the moral strength and that development of the love of the beautiful which is the peculiar mission of the park. A great deal of thought must be given to detail, yet detail should never be so distinct as to attract attention separate from the composition to which it is a part.

The park man, unless it is in the same composition with architectural or engineering structures, abhors straight lines and radial curves, because they do not fit into the landscape. They attract undue attention to themselves. They imply the fact that a physical force has predominated over everything else, for in order to have a straight line a projecting force of sufficient intensity to overcome everything in its way is suggested, and a radial curve is similarly controlled from its center. Now nature never produces what are known as parklike scenes by single forces, but always as a resultant of many forces, differing much from each other as to their nature and character. It is the result of the law, that units of the same kind moving under a general law are so modified by lesser forces that they never individually produce exactly the same results, or reach their location of rest and stability in exactly the same form and position.

There is another law which seems to be a supplement to this; it is: Things which are entirely unlike may be so related to each other in composition that they produce the effect of likeness, or they may enter into a composition in such a way as to produce a unity and wholeness which is entirely unlike any of its parts. It would take too long to discuss this law now. I refer to it for it is needed to balance the first one and shows its limitations.

Let us see how these laws are applied by that master mind, Frederick Law Olmsted, to those common features of parks, roads and paths.

I have tried to show that nature does not allow one force to overcome all others, therefore, in the naturalistic sections straight lines, radial curves and geometrical forms are not to be introduced so they can have no influence in determining the road lines, therefore, the question becomes a single one of deciding certain locations where the road is to be and its direction at those points, and then connecting the intervening spaces. Now as nature allows every force with which its work comes in contact to modify it, so we must allow all the various incidents between the two points to influence its location, such as hills, valleys, trees, rocks, brooks, distant views and local beauty, anything, everything that happens to be along the line under consideration its proportionate influence, and furthermore, if nothing exists to prevent it being a straight line then something should be introduced, such as planting or grading which might have existed naturally by the conditions under which the land was formed and then let these artificial constructions modify our lines

as if they had been natural. Now if this law was to be followed literally without any modification our road might be a perfect medley of twists and turns and grades, but this law like all others must not be allowed to operate alone. It is modified by the second law—that dissimilar things properly united produce a whole. Our road is to be made up of curves which have no geometrical relations to each other and of grades which are free from all idea of straightness, but they must be harmonized in such a way that the result is pleasing. If to obtain this unification it is necessary to cut through hills and fill valleys, to cut down trees and move brooks, it is to be done, even if we apparently violate every one of the conditions of our first law. These two laws if positively carried out would destroy each other, but here comes in that saving grace which is everywhere abundant in nature.

Never have I known a case where these two laws, so seemingly at war with other, cannot be made to produce a harmony, and it is a man's skill in adjusting these two laws, not only regarding roads, but other park features, that decides his standing as a landscape architect. Now comes the question of grades: Wherever there is an ascending grade there must be sooner or later a descending grade, and where they connect is the summit. Wherever there is a descent, sooner or later, comes an ascent and their meeting place is a valley. Were straight grades to be established without modification at their junctions an eaves trough, ridge pole effect would result, so it is customary with engineers to make curved connections both at summit and valley, but in naturalistic roads it is necessary to do more than that; the profile line must be studied by exactly the same laws as the location line has been. While the result will not be anywhere near as violent as in the surface line and may not even be noticable to the ordinary traveler, yet if it does not exist a discordant note has been introduced into the composition.

There is a relationship between the shorter curves with the valleys and summits, and the longer curves with the longer grades and both with the trees, rocks, and other obstructions met in the layout. The law is this: Make the greatest change in direction and the greatest change in grades, and the greatest change in plantings at one and the same place,and let the distance between these points may be as simple and continuous in effect as practical. This method is almost always followed by Mr. Olmstead in his work and, so far as I can learn he was the first to intelligently apply it to park work.

The next point I want to call your attention to is that a park is as much a construction as a city hall or a bridge. The idea that a park is a piece of ground outdoors which can be worked much as a farmer works his land should be exploded, and cities should understand that when they undertake to build a park they have undertaken a work of a similar character, of as great importance, fully as difficult and intricate as building a magnificent city hall. The city offices can be housed in a barn, which might be called a city hall, but it doesn't help the credit or give character to the city. So, any old piece of ground can be called a park, but only to the city's disgrace. Any piece of ground can be made into a park and I care not what its condition is, yet until it is so made it is no more a park than a pile of lumber and bricks is a palace.

Another habit of the people which blocks the way to realizing the need of park construction and care is the consideration usually given to grounds around the homes of ordinarily well-to-do persons. Usually little attention is paid to the ground until the house is nearly completed, then the grader is called in, who recommends "a nice crowning grade from the house to the sidewalk." The nurseryman suggests the planting of angles or borders, a walk is added, many times great efforts are made to have it curved when a straight one would be a hundred times better; trees are planted on the street line and one or two on the lawn, and the grounds are completed, with a tendency toward ornateness instead of that greater charm, simplicity. The owner usually has spent more than he expected on the house and desires to economize on the grounds. A hundred dollars or less is the sum often mentioned as the limit. All this means a low grade of work, want of thoroughness in the doing, and lack of satisfaction in results. It sets a low standard for the ideal. Now, if the builders of homes would recognize from the beginning that the grounds must cost for thorough work from one-tenth to one-quarter what the house itself costs, and that they will cost as much to furnish as the average cost of furnishing a room inside, then the owner would find in this outdoor room of his home the satisfaction and contentment which ought to come from it. He would always have a library of nature's writings at hand where a new and beautiful book would open for his pleasure every day. He would have an outdoor art gallery filled with pictures of the most beautiful colorings, with statues of a most exquisite form, and besides that, and more in line with the pur-

pose of this paper, his knowledge and appreciation of the best at his home would lead him to expect and demand the best for the parks of his city.

My conclusion as to park areas for cities and their relations to its population, income and valuation is as follows:

One-twentieth of the city's area should be reserved for parks and squares. A playground should be allowed at least 300 feet square to every square mile, and in densely populated sections, more than one. Four other small squares should be allowed to the mile, of at least one-half acre each. A thousand acres would then be divided as follows:

Ten acres in playgrounds and squares.

Forty acres for large parks.

One hundred acres in streets and alleys.

Five acres in school grounds, etc.

One hundred and fifty-five acres for public purposes.

Eight hundred and forty-five acres for private ownership.

One-third of the cities already exceed this amount, and twenty-two cities in the United States have one acre or more in twenty devoted to park purposes.

A most common method of raising money for park purposes is by bonds for the purchase of land, construction and other extraordinary outlays, and by appropriations in the annual city budget for the cost of maintenance or other ordinary or transitory expenses.

It has usually been found that if the appropriations are dependent upon the vote of the city government the politicians keep the park within their grasp. The parks are for the public and the public should at all times control them, but as a tree cannot flourish in having an overabundance of water one month and none at all the next so the park must have a steady supply of funds necessary for the care of its plant life, and to keep it in such order as to be reasonably protected, clean and inviting to the public. That it may be so, an ever increasing number of cities are having the money necessary for their park maintenance set aside by the treasurer or that officer whose duty it is to establish the rates, the same as fixed expenses such as interest and money for the sinking funds are raised.

In the study of the cost of park maintenance it is found that the cost in many cities of over 50,000 population equals or exceeds one-half mill on assessed valuation, or sixty cents per capita, or 2 per cent. of total income of city.

If there is one acre of park to two hundred inhabitants and a tax equal to sixty cents per capita is raised there would be one hundred and twenty dollars ($120) per year per acre for ordinary park expenses, which while not sufficient for very large cities where the cost of policing and lighting is considerable, yet is ample for moderate sized cities, certainly for cities under one hundred thousand population.

It is usual to raise money by bonds for park construction and provision should be made for them if needed. As it costs about two thousand dollars ($2,000) per acre for thorough construction work (some parks have cost many times that), and if there is an acre of park to two hundred people, then the bonded indebtedness should not exceed ten dollars per capita. If the bonds run for thirty or forty years then the total amount cost per capita for park purposes would be about one dollar per person, less than two cents per week, that is, two cents per person per week may give to any city in the United States a satisfactory park system, and will give it providing action is taken in time. A city can for convenience or necessity put off for years entering into a well organized park system, but it cannot do so without sacrificing much and at an ever increased cost to its people when it does come, and it is sure to come in time. It is not essential to construct the park or even to make it usable, but it is essential that the city as a whole should be well considered, and after determining both the amount of land needed and its location that it be secured at once and then developed and rendered usable as the means and needs of the city require.

In conclusion, let me say that a new field of labor, a new profession is fast opening, an architect of cities. By this I do not mean an architect for its buildings, but for the construction of the city as a whole, the determining of the relative proportions and locations of its different functions. This is not a call to lay out new cities, for it is the people and not the land that make the city, but a call for a man who has the capacity to take in the existing conditions with the possibilities they represent. Ruskin says: "Architecture does not begin until the utility of the structure has been provided for," so the architect of the city has no call until the city itself has been established.

REPORT OF THE COMMITTEE ON SEWERAGE AND SANITATION.

A. P. Folwell, Chairman, Easton, Pa.

The present chairman of this committee was impressed by the fact that relatively little attention has been paid to sanitation in this society, and it seems to the writer that the greatest service which he can render is to call attention to the importance in Municipal Improvement of certain sanitary problems other than those included under the heads of sewerage, water supply, garbage disposal and parks.

The collection of vital statistics is given more attention in Europe than in America, but our cities are moving rapidly into line. All practical or applied sciences are based upon the results of observation, and these sciences can not be more accurate than the data upon which they are based.

Our efforts to improve the sanitary conditions of the cities must be guided by our understanding of the laws of health and of life as affected by external conditions, and our success can not be expected to be greater than the accuracy of such understanding. As an illustration: It has been claimed that wood-block pavements are unhealthful, because of their supposed tendency to absorb water; but sufficient data relative to the health conditions of various communities which are and which are not provided with wood-block pavements and have otherwise similar conditions affecting their health, have not been collected, and this question can not be satisfactorily settled.

Most of our large cities require every physician, midwife, undertaker, and clergyman to make returns to some public officer of all births, deaths and marriages at which they have served; and also that physicians report immediately all cases of communicable diseases.

The record of cases of sickness is more important to the sanitarian than that of deaths, but is often incomplete for contagious diseases and altogether lacking for all others. Would it not furnish very important data to the sanitarian if every case of sickness were reported to him? A copy of the city map constructed for each disease, in which each case was indicated by a dot, would undoubtedly be of great assistance in detecting local causes.

Much as the present system at the best lacks of satisfying the sanitarian, it is still of great value to him, and it is to be hoped that cities which are not now requiring and publishing the returns of vital statistics will be brought to see the advisability of doing so, and that the scope of the records be enlarged along the lines indicated.

Abatement and Prevention of Nuisances—City life is an artificial life, and natural processes can not be relied upon in urban surroundings to maintain unassisted sanitary conditions, it being more difficult there for nature to restore a disturbed equilibrium. It is therefore necessary for the city to assist nature to restore a normal condition and to prevent the pollution which causes unsanitary conditions. Unsanitary conditions are created by the "smoke nuisance," by the odors from some chimneys, by exposed excrement, by flooded urban land, by anything which totally excludes direct sunlight from a dwelling, and by nerve-wracking noises. Cities should encourage each other to suppress these nuisances by reporting successful methods and by rivaling each other in faithfulness in applying them.

One of the evils of a smoky atmosphere is the excluding of sunlight. Another cause of darkness, dampness and dirt is the hight of modern buildings. The rule which has been adopted in London, is that no building shall be so high as to rise above a line drawn at an angle of 45 degrees with the horizontal from the base of any building opposite either its front or rear; and I believe that the violation of this rule must in the near future cause weak eyes, pale cheeks, consumption and generally lowered vitality in large numbers of the clerks and business men of our largest cities.

Food Inspection—Another class of preventive actions is that of food inspection. Many cities and most states have on their books laws against food adulteration, the enforcement of which is in the hands of special agents. Few of the adulterations used are injurious to anything but the pocketbooks of healthy adults, but infants and invalids may receive great harm from so-called embalming or preservative substances.

Food inspectors are employed by all of the cities having more than 250,000 population; by all but five of the 23 having between 100,000 and 250,000 population; by 29 of the 40 having between 50,000 and 100,000 population, and by 36 of the 57 having between 30,000 and 50,000 population. There seems to be no relation between the number of inspectors

employed and the population—Rochester employing twice as many as Newark, for instance, although having but 2-3 of the population, and New Orleans having three times as many as Philadelphia, whose population is more than four times as great.

The prevention of the spread of communicable diseases is in the power, and is consequently the duty, of the city. Aside from the protection of the milk and water supply, this is best effected by quarantining and by isolation hospitals; by the use of disinfecting apparatus, and by compelling a proper care and disposal of the bodies.

The disposal of the dead, by cremation or by burial, and the location of burial grounds are important subjects. The burial of New York's dead requires annually about fifty acres, or a square mile every twelve years. In view of this the question of cremation may well be considered by large cities where the cemeteries must ordinarily be situated several miles from the centers of population. There are certainly arguments in favor of substituting the crematory for the "potter's field." There were twenty-five crematories in operation in the United States in 1901 and the number is slowly increasing. Thirteen thousand two hundred and eighty-one bodies were cremated in this country in the last quarter of the nineteenth century. Even now, however, not more than one-fifth of 1 per cent. of the dead are cremated in the United States. Data concerning the cost of cremating and of burying the pauper dead in large cities would be of interest.

The providing of public abattoirs and markets and the proper regulation of them will go far towards insuring the people against decayed or stale vegetables and meat, "bob" veal, and other unhealthful kinds and conditions of food. More than one hundred cities of the United States own their markets, and more than fifty of these have a population of less than 50,000, the South showing more in proportion to the total number of cities than any other part of the country. While the smaller cities may not be able to afford the public buildings, neither can they afford to do without careful and frequent inspection of all private slaughter houses and markets. A health officer, generally under the direction of the local board of health, is in most cases the agent for such inspection.

Public fountains and drinking places, the latter especially, are now considered a necessity in all large cities, and many small ones find them worth while. In cities and towns of all sizes drinking fountains for horses, cattle and dogs are even more necessary than for men. Information concerning the amount of water required to maintain these and possible methods of preventing waste; the best locations for them and the number required; the supplying of both ordinary and iced water to human beings, and the automatic cleaning of the cups used; these and other points will reward investigation.

Public baths are of late becoming a more common municipal institution. In 1900 thirty-six cities of the United States had either all the year or summer public baths. In these thirty-six cities are included all three of those having more than 1,000,000 population; two of the three cities having between 500,000 and 1,000,000; three cities having between 250,000 and 500,000 population, or 33 1-3 per cent.; six cities having between 30,000 and 50,000, or 10½ per cent.; six having between 10,000 and 30,000, or 2 per cent. and five places having less than 10,000 and more than 3,000 or 0.5 per cent.

In New York state, by an act of 1895 all cities of 50,000 inhabitants or over must provide public baths.

In Buffalo, Rochester and Philadelphia, probably in other cities also, are public wash houses for the convenience of the poor whose contracted living quarters do not admit of washing in their so-called homes. Both of these institutions encourage and assist in cultivating that personal cleanliness which must go hand in hand with perfect municipal cleanliness. A collection of information concerning the location, structural and mechanical details and administration and popularity of these would be helpful to many cities which are contemplating the introduction or extension of these efficient aids to sanitation.

In our larger cities latrines or convenience stations are a necessity which is but poorly met. Most large parks contain such stations; but in the business districts where thousands congregate daily the saloon or hotel for men and the larger dry goods stores for women are looked to to furnish as a convenience (which the sensitive person feels should be paid for by a perhaps unwished for beer, cigar or ribbon) what the city should provide for all as their right. European cities are far ahead of us in this respect, although we would not be satisfied with the regard paid by them to more or less conventional modesty. New York has made a beginning of supplying such stations underground in the business district. The home water closet in the cellar, basement, or under the back stairs has been pretty well abolished; and while an underground

municipal closet is better than none, it would seem that the same arguments which were advanced against the private dark-closet would hold against the public one.

Drainage—There are two classes of wet lands often found in and near cities, and these should be drained—natural swamps, and lands flooded by street grading which are too low for a natural surface outlet. The latter are objectionable because making the ground in their vicinity moist for a large part of the time and thus causing damp cellar and unhealthful ground air; because they are used as convenient points for drowning cats and dogs and for the secret and convenient disposal of garbage and other refuse; and because they form breeding places for mosquitoes, which are both unpleasant and, it is believed, dangerous as carriers of malaria. Natural swamps are objectionable for the latter reason, as well as because they might if drained be utilized to some profit.

Earth Excavations—The danger of sickness resulting from trenching or other excavation in the North is not so great as in the South; and yet epidemics of what is generally called malaria have undoubtedly accompanied many cases of wholesale excavation for sewerage or water works systems even in this latitude; while in the South yellow and other fevers are thought to result from excavations in hot weather. That such results can be avoided was apparently demonstrated in Havana, during the United States' occupancy, when a large percentage of the streets was dug up for sewers and pavements during all seasons, while the sickness in the city meantime was but a small fraction of that which had always existed previously; the treatment of all fresh earth with chlorine obtained by the Woolf process being credited with the innocuousness of the excavations. Data going to prove or disprove the popular impression that excavations cause sickness, or to demonstrate under what conditions of temperature, soil or air this is true, would be of value.

The writer would also like to see discussed the advantages and disadvantages of alleys, taking into consideration the general tendency to use them as places for depositing all kinds of filth.

RESIDENTIAL SEPTIC TANKS.

Burton J. Ashley, Zion City, Ill.

In the year 1890 the writer moved into one of the suburbs of the city of Chicago, where there was neither water nor sewer service.

The dwelling had been provided with all the modern improvements so far as the plumbing was concerned, which could in no way be of use without such services. Water service was therefore provided for by pumping storm water from a cistern to a tank in the attic.

Sewer service was secured through the construction of a four-inch vitrified pipe to a small slough about two hundred feet away. Near the house had been constructed a catch basin four feet deep and three feet square, with about two feet lying below the trapped outlet. The inlet was not trapped and therefore found ventilation through the soil pipe above the roof. The overflow of the storm water cistern above alluded to was also turned into this catch-all for the purpose of affording, as we thought, necessary flushing accommodations.

Nearly two years elapsed before we heeded a long existing conscious call to clean out this catch basin, and discovered the fact that the receptacle had not needed cleaning.

Two years later another attempt resulted the same as before.

Some time later a short article beneath an unusual heading came before our eyes and we read it and became aroused to the fact that we had had in excellent operation for more than six years a septic tank.

The wastes that had been entering this tank were of the ordinary kind produced by a household, which in this case consisted of from three to five persons.

This crude appliance has now been in successful operation for twelve years, in which period it has not been cleaned out to exceed five times, and each time with the result that the sludge was of such insignificant quantity as not to require removing.

Somewhat recently it became our lot to design and assist in building a city to cover ten square miles of territory, two square miles of which at the present time has largely been built upon. One of the controlling factors in our design of the land was the matter of drainage and future sewer service. The future purification of the sewage as it would be controlled by the topography of the area, as a matter of course, came in for a fair share of attention.

We have concluded upon adopting the separate system of sewers as being the most rational one for the needs and

shall, therefore, carry this design out as largely as consistent with the physical conditions with which we have to deal. In concluding upon this system, we had not forgotten our experience with the septic tank at our residence as hereinbefore related.

Many farm drains course more or less frequently through the territory and are

B. J. ASHLEY, C. E., CHICAGO, ILL.

temporarily available for the drainage of the many cellars that have been built and that are being constructed.

A demand for entrance into these and other available outlets very soon sprang up which was granted and finally encouraged so far as these outlets had the capacity, and following this came a stronger appeal for sewer service, which because of the greater need for improvements of much more importance was necessarily denied, but we advised the construction of these small septic tanks where drainage was available and permitted the effluent from them temporarily to enter the drains just spoken of. These tanks, when permitted, were required to be constructed after plans made by us and under the supervision of the chief engineer.

The bottom of the tank is made of concrete, the walls of brick finished at the top of the ground the same as an ordinary sewer manhole. The interior below the discharge pipe is washed with four coats of pure cement wash.

The plan of tank adopted, is circular, three feet in diameter and for the most part three feet from the under side of the outlet to the bottom of the tank. Inlets and outlets to these tanks are placed

on opposite sides to each other, are made four inches in diameter, are placed on the same elevation and enter the tank with a down turned elbow, that the flushing in of the wastes from the soil pipe or laundry or the discharge of the effluent may not disturb the scum.

The capacity of the tanks is varied according to the number of people whose wastes pass into them, but for the most part contain about one hundred and sixty gallons, which, compared to the service reputed to be rendered by the city's tank at Champaign, Ill., would be sufficient to accommodate the wastes produced by from eight to twelve persons.

The first residential septic tank constructed in Zion City was made the size above described and served the household of twelve persons for a short time when the construction of an office building on the immediate lot, required it to further serve ten more persons, but who only occupied this building during the day, and from which there came into the tank no wastes save from the lavatories and water closets.

We at once feared this tank would be overtaxed and therefore immediately set up a close watch on its action.

At the end of about six weeks after the tank had been put to use, a scum of about two inches in thickness had formed and septic action was going on in a satisfactory way. At this writing the tank is still doing duty with a good healthy scum of about four inches in thickness and emits scarcely any odor. The sludge has not been examined and of it we cannot speak.

Other similar tanks in the city are under more favorable conditions operating very satisfactorily.

We have also designed and constructed two tanks of the oblong type for the use of a factory that will soon employ about a thousands hands, but owing to the limited requirements of them as yet the tanks are not in good working order.

Taking a position which is largely based on our own experience, we have determined in the building of the city to require the universal construction of residential septic tanks, believing the effluent therefrom will be sufficiently liquefied and made incoherent by the bacterial action as to render the sewers into which it flows immune from greasy incrustations which are so much deplored by the sanitary engineer, as well as to decrease the demand for the installation of flush tanks at the upper ends of small laterals.

Gradients, we believe, can also be reduced under this arrangement of things below what is now considered to be the minimum, in the design and construction of the general class of sewers.

We believe in case there should ever arise a demand for further purification than what is secured by the residential septic tanks, then the cost of providing such a plant for the further treating the sewage of the city at one place in one volume would be minimized.

The costs of further purification will be very materially reduced if not in some instances wholly eliminated. Taxation for the construction and maintenance of an expensive purification plant and for the scraping and cleaning out of the sewers would scarcely be required or at least be materially lessened in the case at Zion City, where the effluent has nearly a mile to flow in an open channel before it reaches the waters of Lake Michigan.

Of course offsetting this will be the cost of the periodical inspection of the tanks, while a triennial or quadrennial cleaning could be secured at a less cost we believe than through the means of a municipal purification plant. There is no rational means sufficiently reliable to assist us at this stage in estimating the difference in cost of such maintenance, but we feel fully justified in the course taken and hope in the future to offer something more definite in regard to this scheme we have adopted and for which we have no precedent.

For the designing, locating and construction of these tanks during the early days of our city building ordinances and rules have been adopted and are strictly adhered to.

THE BIOLOGICAL SYSTEM OF SEWAGE DISPOSAL.

John N. McClintock, Boston, Mass.

It is only a score of years since Amasa S. Glover (in 1881) proclaimed to the world the liquefaction of the solids in sewage by bacterial action and a chemical process, and the escape of the water in a practically pure condition from properly built receptacles; and it is only seven years since he told the public how to care for the sewage of a community without offense of any character by combining the aerobic action of bacteria in the filter beds with the anaerobic ac-

tion previously obtained in his liquefying tank.

Last year I put in a small plant to care for the sewage of a private residence near Boston. It had not been touched, nor did I visit it again until this summer, when I accompanied an investigating committee of the Massachusetts legislature to the works.

We raised the solid iron cover of the septic tank and detected no offensive ordor until the crust-like surface of the sewage was disturbed by investigation made as to solid matter deposited in the

J. N. McCLINTOCK, C. E.,
Boston, Mass.

tank. We could not detect any solid matter. We visited the well that receives the effluent from the secondary filter bed of the system and drew water from it as clear and sparkling as from a mountain spring.

The two compartments of the septic tank hold about 1,500 gallons, or the estimated flow of twenty-four hours. The primary filter, under three feet of earth, and the secondary filter, under seven feet of earth, together consisting of fifteen cubic yards of gravel, brought from a distance and sorted by twice sifting into three sizes, have a total bulk of 3,000 gallons, with spaces amounting to 1,000 gallons. In other words, the whole system would hold 2,500 gallons of water.

During the time this system had been in operation 3,000 gallons of solid matter, upon the basis of the Lawrence experiment, had been carried to the septic tank, and not one ounce had been removed by the pump, only by way of which could the solid matter escape from the system. Now what becomes of the solid matter that was carried to the tank during the year? I claim that 95 per cent. was eliminated in the tank itself by septic action; that 90 per cent. of the dissolved organic matter in the sewage was disintegrated and converted into its inorganic elements by the same action; and that 85 per cent. of the bacteria of putrefaction was retained in the septic tank; that the primary filter of ten cubic yards, filled slowly and discharged by a syphon, eliminated 90 per cent. of the impurities of the effluent from the septic tank or in connection with the septic tank 99 per cent. of the pollution of the original sewage; that the bacterial action and chemical process in the secondary bed of five cubic yards effects a further purification, removing 99.9 per cent. of the pollution in the crude sewage, all of the suspended matter and all of the bacteria.

I propose to call your attention to the methods of availing of the Glover system of sewage disposal to the best advantage of the municipalities in which you are personally interested.

The tank may be of any suitable construction to arrest the solid substances in the sewage and permit the escape of the liquid portion. The capacity may be from twelve to thirty-six hours' flow, or from 50 to 150 gallons per capita. If the community to be served is liable to increase in size in the immediate future, it is well to build tanks holding twenty-four hours' flow with provision for increasing their size when desirable by the purchase of enough land in the first place for all possible demands.

It is well to build the tanks in series of two or more, so that any one of the series may be shut off from service for the purpose of repairs or cleaning without interfering with the action of the system. It is also well to provide gates for directing the sewage into either end of the series.

A covering or roof over the tanks is advisable if only to keep the gases under control. The roof may be of the plainest kind of lumber or of the most permanent description such as masonry or concrete. An artificial roof over the tanks may not be essential, as nature forms a roof over the surface of the sewage in a short time after the work of the system commences; but it is well to shut out of the tank the wave action caused by the wind as well as the direct rays of the sun. It is well established that decay or rot takes place more quickly and effectively in a dark and

damp place than in a well lighted and well ventilated place.

As sewage carries more or less insoluble and inorganic matter, especially where the combined system of sewers is used, it is well to provide in the construction of the tanks means by which the solid matters in the sewage, which septic action will not disintegrate, may be drawn off and disposed of. In small systems a manhole may be sufficient, but in larger systems sludge filters may be built with advantage upon which the sludge may be drawn by gravity or pump. If the works are in a locality where the manurial value of the sludge may be utilized with advantage, it is well to construct the first compartment of the septic tank to hold about one hour's flow of the sewage so that it will act as a settling tank with provision for composting the sludge.

The primary filter of the system may be of twice the capacity of the septic tank or hold one cubic yard of filtering material per capita. The depth of the filter may be from 3 to 15 feet, the former depth requiring less strength in the separating walls between the beds. A good standard of depth is five feet.

The object of the filter is to present a great surface to which nitrifying bacteria can cling and generate and perform their functions of nitrifying the dissolved and suspended organic matter brought to the filter from the septic tank, and for this reason the material should be of small and uniform size. Experiments have demonstrated that a proper sized material will go through a one-half inch but not a ¼-inch mesh. Material the size of road metal or from one-half to two inches in diameter is sometimes used in the primary or rapid filter. If different sizes are available it may be well to use the finest on top of the filter to act in part as a screen to arrest the suspended matter that escapes from the tanks and prevent the possibility of the clogging of the filter much below its top.

The filtering material may be of any kind that will withstand the action of bacteria and water, like gravel, broken stone, clinkers or coke.

The beds may be of any form, but rectangular and oblong are generally used with inlet at same end as outlet.

Beds should be in series and operated in pairs that while one is slowly filling its mate may be aerating after discharge of its contents automatically or otherwise. Underdrains should permit free escape of water and inlet of air.

Secondary beds may be of same depth and from one-half to two times the size, according to degree of purification required. Material should be of finer sizes than in the primary beds and may be of sand or fine gravel. Secondary beds may act intermittently or as constant contact filters and should be drained like the primary beds. Ventilators are required for the beds if they are covered, to permit circulation of air. By the above arrangement of tanks and filters 1,000,000 gallons of sewage can be purified on an acre or the wastes of 5,000 people on a half acre.

The ground above can be used in any desired manner for lawn, park, street or otherwise.

The same system can be applied to the purification of water.

SEWER MAINTENANCE. UNDER WHOSE SUPERVISION AND WHY.

John H. Emigh, City Engineer, North Adams, Mass.

The first requisite for successful maintenance is good construction.

The second requisite for good maintenance is systematic vigilance.

There is probably no more efficient and economical method of keeping the sewer clean than frequent flushing. Probably no device has reached a greater popularity than the automatic flushtank. If used it must be frequently inspected to see that it is properly doing its work. It requires a considerable quantity of water, and the writer doubts that its advantages are sufficient to recommend its general adoption. It is probable that regular and thorough flushing once in each three or four weeks is as often as is necessary except in special cases. A 3-inch or 3½-inch pipe direct from the street water main to a manhole will, under ordinary pressures, deliver an abundance of water, and if these connections be made once in about 1,000 feet the man in charge can, without great trouble, thoroughly flush any and all parts of the sewer at the time he is making his examinations. A stronger flush may be obtained by plugging the outlet, nearly filling the manhole with water, then withdrawing the plug. If this is done at any other place than at the head of the sewer care must be taken that the water does not overflow into low fixtures of the neighborhood.

Laterals entering from factories and similar buildings should be provided with

some arrangement for keeping from the sewer anything that is likely to form in it an obstruction.

A manhole near the outside of the building, its bottom made slightly below the outlet, enough so that the discharge is made first into a quarter turn, opening downward, works very well.

There is frequently an accumulation of gravel or street dirt that greatly reduces the capacity of the sewer or stops it entirely, especially wherever the higher parts of the system are in dirt roads along steep hills. The strong wash along street surfaces carries gravel and sometimes stone beyond the catchbasin trap into the sewer, thence to the flat grades, where the reduced velocity allows them to stop and accumulate. These places of accumulation should be watched and frequently attended to.

J. H. EMIGH,
City Engineer, North Adams, Mass.

If taken in time the obstructions may generally be removed by a strong stream of water obtained by a direct connection with the street main, as already described, or through a line of hose attached to the nearest hydrant. Sometimes a heavy chain with knots in it may be drawn either way in the sewer, thus loosening the material that has been deposited.

Much of this may be taken from the next man-hole below if a shoveler is kept constantly at work and the water is made to flow over a blocking which covers the lower half of the outlet of that man-hole.

When the sewer is large enough so that men may conveniently work inside it becomes simply a case of shoveling the material and conveying it out by an arrangement that best suits the conditions.

When the sewer is entirely stopped the problem is one of greater difficulty. No rule can be set down for its treatment and the solution must be as the case requires, even to the taking up of a portion of the street if necessary. Ordinarily the obstruction must be worked at from the man-hole next below. Sometimes a sewer may be probed for 200 or 300 feet by a rod made up of sections, either in wood or iron, each 3 or 4 feet in length, joined at their ends by "Felton's Improved Coupling." These constitute a convenient arrangement and may accomplish the purpose in small sewers of from 8 to 12 inches in diameter. Sections made of wood are light and easily carried about. A stronger rod and one capable of greater length may be made of ½ or ⅝ iron pipe, cut in sections of the same length as above described and fastened together by screw couplings. This, with hook or claw at the end is likely to accomplish much better work than the other. It is slower to make up and much heavier to handle than the one made of wooden sections. A water-jet may, at times, be very useful. Perhaps a mirror may be made to throw sunlight into the sewer and help to determine the location and character of the obstruction.

Keep a tabulated record of the date, character, location, cost of removal and such other explanations as may seem wise as well as a record of the flushings.

Cleaning catch-basins is an important item of maintenance and one of the most expensive unless well managed. As suggestive of a good method now being used I quote from a letter recently received: "All catch-basins are numbered and are regularly inspected by a man who records the depth of dirt in each. From this record lists of the basins needing cleaning are made out and given to the cleaners, with the route they are expected to follow. The cleaners make a return each day of the basins cleaned and of the number of loads taken from each. From these returns we obtain a check upon the work each cleaner is doing and are able to obtain the cost per cubic yard of the material removed from the basin. When the cost per cubic yard runs above normal figures we detect it and at once investigate the cause. By the adoption of this method we have succeeded in greatly reducing the cost of cleaning. (I believe it to be capable of still further reduction), and obtain a record of each basin which is valuable in case of complaints. By this method the men do not stop to clean a basin that has three feet of water and only

one foot of dirt but attend to only those basins which need attention. They do not have to be accompanied by a foreman, as the returns show the amount of work done each day." The same writer says that the cost per cubic yard for removing and hauling away was $0.665 in the year 1899 and was $0.68 in the year 1900. The haul was probably about 2,000 feet and the difference in cost probably due to the difference in length of haul.

The manner of connecting house laterals with pipe sewers is a matter that belongs frequently to maintenance and is of considerable importance, especially if no Y has been provided, in construction, for the connection. Cutting an opening through the side of the sewer should not be allowed. Removing a length of pipe and replacing it by another that contains a Y branch is objectionable because any considerable run in the sewer or the run turned on before the cement has had time to set is very likely to result in leaky joints. Taking up three or four lengths of the old pipe in order to not be obliged to cut away any of the bells in relaying is open to the same objection. The writer believes there is no better method than to excavate entirely around the pipe and encase it in brick masonry or concrete nearly to its top, then carefully cut the hole in the top of the sewer and join the lateral to this by a quarter or an eighth bend, making sure that none of the smaller pipe extends inside the shell of the larger pipe; then continue the masonry to cover the joint thus made. This, if properly done, does not weaken the sewer, nor cause it to leak or become rough on the inside. It may reduce somewhat the grade of the lateral but this it should be able to stand or the elevation of the fixtures is dangerously close to that of the sewer.

The third requisite for successful sewer maintenance is a right kind of a man to do the work. If the system is large divide it into sections and select a man for each, all subject to the direction of the head of the department. The man should be intelligent, reliable, and have a reasonable amount of common sense.

He must, like every other man, in order to do good work, feel that he has a responsibility and is being trusted. The one under whom he works must show that good service is appreciated and must, as far as possible, make use of the subordinate's judgment.

The question of maintaining ventilation is a somewhat difficult one especially in dirt roads. In paved streets a perforated manhole cover seems reasonably satisfactory if the perforations are kept open but in the dirt road they are very liable to become stopped; yet there seems to be no better method even here. To obtain good results they must be watched and frequently cleaned.

Under whose supervision should the maintenance of sewers be placed? This cannot be answered by the man's municipal title. He should not only be competent to design and construct but he should have had experience in it. A knowledge of the theoretical and the practical are most desirable qualifications for supervision of maintenance. He should not only be capable of reading drawings, but of making them. He should know when to make them and of what.

He should be most familiar with the system and should be able to decide quickly what should be done for the difficulties that are likely to arise.

He should attend to a clear and concise record of the work done kept in a form convenient for reference. Finally he should be able to establish a co-operation with his men and a condition of mutual confidence. At the same time he must be master of the situation and must see that his orders are obeyed.

UNDERGROUND WORK.

William W. Armstrong, State Senator, Rochester, N. Y.

From anything like a professional standpoint the topic you have assigned me is appalling. My special information upon the subject is usually derived from bills for local improvements which generally seem exorbitant, and my gasping inquiry as to the cause is usually met by the reply that the excavation disclosed unexpected difficulties, or that the foundations were unusually expensive, or that in some other manner the underground work not now visible soaked up the money like a dry sponge. I realize that you cannot expect me to enter upon the practical discussion of underground work. It will be much better, therefore, if as a citizen and interested observer of public administrations as they come and go, I should take the liberty to say something not directly upon the subject, but quite akin to it

In these days of new charters and business administrations and individual responsibilities it has seemed to me that in our endeavor to be practical we have sometimes lost sight of the very essen-

tials which underlie every healthy municipal condition. Our public improvements are planned by and executed under the supervision of our public officers. Now how do we arrive at the choice of these public officers?

In the first place in pain and travail we bring forth our candidates; then no sooner is the candidate produced than he is assaulted on every side and subjected to all the varied and torturing abuse which the fertility of our civilization can invent. Public confidence in him is undermined, and if half the charges alleged against him were true he should be put in a public prison rather than be installed in a public office.

SENATOR W. W. ARMSTRONG,
Rochester, N. Y.

Having proceded thus by methods which, to keep in sight of my text, I will call underground, he finally is elected with spirits humbled and a consciousness that he is already distrusted, not to say mistrusted, by a large proportion of the people whom he has been chosen to serve. All our election machinery, both visible and underground, is not for the choice of a partisan ally, but of a public servant; his first duty is to the whole people of the community from which he has been chosen.

But as if to destroy the last hope of the successful discharge of his duties, the people whom he is to serve, and often the very portion of them by whose votes he has been elected, then surround him with bands playing "Yankee Doodle" in front of him and "Dixie" behind him, and demand of him that he keep time to both tunes. Is it any wonder that public work is expensively and sometimes inefficiently performed? Any private business managed in such a way would go into bankruptcy, because there would be nothing else for it to go into. If any private corporation should proceed to the selection of those to whom it purposed to entrust the management of its affairs, first, by an acrimonious dispute as to their qualifications, more particularly as to their private life and other collateral maters than as to their special fitness for the performance of the work, and then, after having made them conscious of the distrust and suspicion of the stockholders, should finally employ them and immediately set about the undermining of their efforts by rancorous criticism and a refusal to believe them actuated by good motives, do you think that the affairs of that corporation would be apt to prosper? And yet that is the condition under which many municipal corporations at present conduct their affairs.

Municipal character ought to be just as valuable as private character, because it is the underground work, the foundation upon which the municipal life is builded, and yet just as private character necessarily must be to some extent undermined by assaults like this, of which I have been speaking, so municipal character must suffer by these so-called practical methods of modern political warfare, and especially so because municipal character so largely is built from and dependent upon the personal character of its public officers year by year.

I take this opportunity, therefore, to make a plea for a little more humanity in present day methods of choosing and electing our municipal officers.

Why not cultivate civic pride, public confidence, individual patience, cheerful good will, loyal support, an effort to appreciate instead of to misconstrue the motives of our public servants, and a general effort all along the line to avail ourselves of the strength of those we choose for our public places, instead of indulging in a discussion and parade of their weaknesses, so that altogether in harmony both of purpose and of action we may unitedly progress along the pathway of municipal improvement?

If this plan could be adopted my experience in public affairs leads me to believe that we would prepare an underground work which would not only permit of the erection of a better superstructure, but support it better after it has been erected, and, what is quite worthy of notice from an engineering standpoint, practically eliminate the great problem of annual repairs.

REPORT OF COMMITTEE UPON ELECTRIC STREET LIGHTING.

C. H. Rust, Chairman, Toronto, Ont.

Previous committees have referred to the difficulty and unsatisfactory results obtained in collecting data regarding this subject and your committee did not consider it necessary to send out question blanks, but submit with this report statistics copied from bulletin 4,284, issued by the General Electric Company, giving the average hours per year, cost of coal per ton, contract price per lamp per year, cost to city per lamp hour, and watts per hour for 1 cent., in the different states.

From this bulletin it is observed that the use of the inclosed arc lamp is rapidly supplanting the open lamp, which was formerly so largely used, and also that the use of the term "candle power" is omitted. "the watts at lamp terminals" being substituted.

Your committee think that in the interests of the citizens, municipalities in granting franchises for street lighting should use great care in not extending the franchise for too long a period, and in all large cities should insist upon the wires being placed underground, particularly in the central districts. The lamp posts should be of iron and of the most improved design and all the work should be done under the direction and approval of an electrician to be appointed by the corporation. Frequent tests should be made for the purpose of ascertaining if the lamps are giving the light provided for in the agreement.

Your committee are of the opinion that it would be in the interests of the citizens if all street lighting plants were owned by the municipality, but when the street lighting is carried out by a private corporation the city should receive a percentage of the gross receipts.

A large number of cities and towns in Europe now own electric lighting plans and we believe that the lighting of the streets could be done more efficiently and more economically by the municipality than by a private corporation, providing party politics could be eliminated from our municipal governments.

Average for each state named.

O—Open arc lights.

E—Enclosed arc lights.

ARC LIGHTING STATISTICS.

	Hours per year.	Coal per ton.	Contract price per Lamp per year.	Cost to city per Lamp per hour.	Watts per hour for 1 cent.	
					O	E
Alabama	3715	$2.26	$ 83.94	$.023	189	206
Arizona	2845	6.66	112.00	.038	77	183
Arkansas	2684	2.57	111.82	.043	107	100
California	2365	7.48	94.50	.042	102	144
Colorado	2904	1.61	95.68	.036	150	110
Connecticut ...	2759	4.08	83.58	.034	121	181
Delaware	3783	3.29	92.33	.024	192	206
Dist. of Col.....	3943	3.05	72.00	.018	266	...
Florida	2607	3.88	117.00	.0445	72	113
Georgia	3216	2.87	78.08	.0221	232	201
Idaho	4000	....	116.00	.029	172	183
Illinois	2291	1.68	67.57	.034	140	183
Indiana	2483	1.96	65.72	.026	178	175
Ind. Ter.....	2179	3.33	120.00	.055	...	...
Iowa	2016	2.02	68.34	.038	121	152
Kansas	2514	2.26	84.09	.035	154	157
Kentucky	2963	1.82	77.10	.033	193	170
Louisiana	3535	3.40	114.83	.032	130	57
Maine	2563	4.66	65.44	.3095	110	296
Maryland	2963	2.67	68.50	.024	117	256
Massachusetts	2596	4.33	85.86	.039	120	109
Michigan	2212	2.52	105.41	.033	155	177
Minnesota	2201	3.94	39.70	.019	143	149
Mississippi	2690	2.63	$1.00	.030	146	181
Missouri	2425	2.06	82.59	.042	123	156
Montana	4000	3 15	126.60	.032	139	138
Nebraska	2265	3.02	92.98	.040	87	176
Nevada	4000	8.25	148.00	.037	161	...
New Jersey	3737	2.95	89.42	.025	172	200
New Hamps're	2714	4.55	72.82	.032	106	211
New Mexico ...	4000	3.15	132.00	.033	145	...
New York	3030	2.81	75.90	.028	170	189
N. Carolina	2525	3.49	70.00	.03	253	163
N. Dakota	2316	4.09	95.00	.0454	200	...
Ohio	4049	1.566	38.92	.014	184	200
Okla. Ter.	3393	3.17	101.33	.034	210	190
Oregon	3210	2.25	103.56	.038	139	187
Pennsylvania .	3701	1.90	60.59	.018	241	277
Rhode Island ..	2748	3.89	105.54	.037	110	143
S. Carolina	2762	3.49	71.36	.027	169	141
S. Dakota	2608	4.36	121.38	.049	103	100
Tennessee	2909	1.805	79.18	.029	189	169
Texas	3265	2.99	102.68	.032	150	168
Utah	3095	....	80.00	.029	266	108
Vermont	2556	4.87	70.85	.033	139	153
Virginia	4006	2.82	64.06	.018	221	297
Washington ...	3733	3 52	99.69	.026	230	149
W. Virginia	3863	1.72	65.83	.017	260	283
Wisconsin	2494	3.41	51.30	.032	151	153
Wyoming	3677	2.10	164.54	.053	108	113
Hawaii	4000	W.P	96.00	.024	...	...
Totals and Averages ..	3020	$3.23	$113.08	$.0321	161	170

ELECTRIC STREET LIGHTING.

Alex Dow, Detroit, Mich.

This talk, like Gaul of the ancients, into three parts divided is. I will not attempt to establish between the three any literary continuity, knowing that to this audience the connection is obvious.

The first part of the subject is "Methods of Electric Street Lighting."

At present the electric arc predominates to such an extent that the other possible methods are almost forgotten. I believe this is due to the public demand for brilliance rather than for illumination. The people in our cities insist on having lights that look bright in preference to uniform illumination of the roadway. This is theoretically wrong. The object of street lighting is to furnish a sufficient substitute for absent daylight. Such a substitute should give uniform illumination over all the area to be lighted. It should not be characterized by spots of dazzling illumination with intervening lengths of semi-darkness. Increased expenditure should mean the reduction of the illumination throughout the system without—as is too often the case—the leaving of spots or districts in absolute darkness.

In the beginning of electric arc lighting this theory was recognized in the introduction of the tower system, which still survives in Detroit. Groups of arc lights placed at a hight of 125 to 175 feet above the street do really give light sufficient for travel over a greater area than will the same number of lights set on posts at the usual hight. I used to demonstrate this to skeptics by showing them that at the distance of a thousand feet from a four-light tower, a pool of water, or a crack in the sidewalk, or even a silver quarter dollar dropped on the sidewalk would be readily distinguished by the traveler. The method has its obvious defects. It is useless where the streets are heavily shaded by trees and it is inefficent when the streets are disproportionately narrow or crooked. It shows at its best on open boulevards or on the wide streets bordered by comparatively low buildings of the middle western cities, in which it was first installed. In such places the tower system is effective and economical. Nevertheless the public will have none of it. The public insists on having its eyes dazzled; and the public comments on the lighting of its town (or of some other town which it happens to be visiting) not with reference to the good traveling light which may (or may not) be found on each and every street within the city limits, but by the blaze of glory on the main downtown streets.

When good distribution is sought, there is much to be said in favor of incandescent lamps placed at frequent intervals. The comparatively low efficiency of the incandescent lamp—about 3 watts per candlepower—as compared to the one watt per candle power of the arc, is the disadvantage. The small amount of care required and the possibility of giving a limited but uniform amount of light over a large territory have maintained the incandescent lighting system in operation in many villages. Between the arc lamp and the incandescent lamp in efficiency comes the new illuminant—the Nernst lamp. This so far has been manufactured only as an alternating current device, but the makers announce that they expect to have direct current lamps presently on the market. The color of the light—a yellowish white—is pleasant. The distribution of the light, due to the reflector, which is an essential part of each lamp, is excellent. The efficiency, while still much lower than that of the arc, is higher than that of the incandescent lamp. I expect to see the Nernst lamp used largely in markets, on bridges and in parks; and to extend from these to some extent into the general lighting of streets.

In arc lamps, the series alternating inclosed arc is at present the favorite. Its advocates have claimed and are still claiming for it a great many virtues, such as superior color of light, superior distribution below the horizontal plane, and even in some cases superior efficiency over the direct current arc. The claim of superior distribution is well made. The other claims may be set aside as unfounded. The true strength of the series alternating arc is that in combination with the constant current transformer—in common parlance, the "tub" transformer—it admits of convenient generation of the power and of great reliability in distribution. The tub transformer is the lineal inheritor of the vogue of the old-fashioned Brush open-coil dynamo which remained for so many years a favorite with street lighting engineers, because of its reliability and in spite of its admitted inefficiency.

I admit that in many instances there is an improvement in lighting as a result of the substitution of alternating series arcs for old-fashioned direct current arcs. This is due to some extent to the better

distribution of the light. The alternating arc gives its greatest radiance on and near a horizontal plane. The inclosing globe, which is usually made of opalescent glass, is purposely shaped so as to refract enough rays downward to prevent there being any shadow directly below the lamp; and the reflector with which all alternating lamps for street lighting are equipped is carefully designed to reflect the rays which would be lost above the horizontal plane into the area where these will do most good. Each modern alternating arc is in fact a demonstration of the rule that uniform distribution of the light is desirable. You will remember that the old-fashioned open arc, with its clear glass globe, so distributed its light that there was a black patch immediately under the lamp; next a circle of vivid illumination; then, beyond that circle, much fainter illumination tapering off into blackness. This is the natural distribution of the light from an open arc. The distribution from an inclosed arc is naturally better, but the results obtained with modern street lamps are largely due to refraction and reflection. If you will equip an old style open arc with a properly shaped and tinted globe and a proper reflector, you will get just as good distribution and just as much effective light per kilowatt hour of energy as with the very best of the new style lamps.

The direct current series enclosed lamp is installed in several cities with very satisfactory results. Boston, Mass., and Grand Rapids, Mich., are instances immediately in my mind and I hear that some other large cities propose to change from open direct current arcs to this kind. The trouble about the direct current series enclosed arc is that its use involves the running of special dynamos, which dynamos are of comparatively low efficiency. Outside of this disadvantage, this lamp has all the good points of the more popular alternating enclosed arc, and it must be said in favor of the direct current that it does not disturb adjacent telephone systems as does alternating current; and that underground circuits already in existence for street lighting in many cities do not require rearrangement or reconstruction which would be necessary if alternating arcs were to be used.

Improvements in street lighting methods to be looked for in the near future will be in details of arc lighting. The most important will probably be improvements in carbons. The excess of violet rays in the arc light, particularly the alternating arc, has long been recognized as a defect. No substitute, however, for pure carbon has yet been developed to the point of practical use. At the present time various methods of treating carbons are being experimented with. One of these—the Bremer method of treatment with sodium salts—is in use to a limited extent. The light produced is a bright orange yellow and the amount of useful light per watt is considerably greater than with pure carbon. The color would be offensive indoors, but on the street the effect is surprisingly good. Unfortunately the treating of the carbon alters all the electrical constants of the arc, and a novel design of lamp is necessary.

Carbons known as flame carbons have been produced in Europe. These also give a yellow light. These are offered for use in ordinary open arc lamps, but the lamps must be adjusted to give an arc from one to one and one-fourth inches long. Other experimenters are working with materials different from carbon. I expect to see quite a line of carbon substitutes offered to us within the next two years, and from some of them I expect good practical results and a marked increase of efficiency.

The sorrow about all such improvements is that the adoption of any of them means the throwing on the scrap heap of a large part of our present equipment. This price for improvement has been paid many times in the electric street lighting industry; albeit that our industry is very young. It is only nine years since I made the preliminary plans for the Detroit public lighting plant under orders that I should not merely design a plant that would be up to date, but that would be ahead of its time. I drew specifications for series dynamos larger and more efficient than any then on the market. Before the Detroit plant was in operation one year, such dynamos were not only standard, but were outclassed by newer productions. During these nine years good practice has changed from large dynamos to still larger; from open arcs to enclosed arcs; and from direct current to alternating current, and as I have just noted, changes in or substitutes for carbon may make our present equipment of lamps obsolete within two years.

The second part of the subject is 'Cost of Street Lighting." I do not think there is any longer much question about the operating costs of an electric street lighting system. There certainly is no question among engineers. We know that with a well designed steam and electric plant supplying light all night to the arcs of 450 to 500 watts which are essentially standard street lights nowadays, the variations in operating costs between cities will be merely the

local variations in the cost of fuel and labor. Such an arc lamp run all night and every night for a year will require the burning approximately of 9,000 pounds or thereabouts of reasonably good coal—say coal of 13,000 heat units. That weight of coal will provide for banking the fires and for the ordinary heat losses of a well planned station. The arc lamp of the enclosed alternating type will, with a reasonable allowance for waste of stubs, require about seventy 12-in. carbons during the year. It will probably require three inner globes, and unless the small boy with his sling-shot is under unusually good control, one outer globe each year. Trimming the lamp and giving it the thorough cleaning and readjustment which it should have at least once a year will require about five days' time per annum of a competent man, and that five days labor will be sufficient to also take care of ordinary repairs to overhead lines. I have said nothing about labor at the power house because that varies so rapidly with the size and character of the power house equipment, but power house labor at most is a comparatively small item. It may be taken, including the ordinary repairs to machinery as costing the same per lamp as the trimming and outside work. In a station operating 300 lamps or more, it will be less. Add what you please for superintendence and office expenses and you will find that your cash costs may readily be as low as $40.00 per lamp per annum and they are not likely to exceed $50.00.

The difference of opinion as to costs begins when fixed charges and depreciation are taken into the account. Here we find there are great variations, not only in practice and experience as to depreciation, but in the capital on which these charges have to be calculated. The investment in a public lighting plant, comparing the simplest village plant with the city plant whose real estate cost is excessive and whose conductors are underground, may readily vary from $200 per arc lamp to $500 per arc lamp. I need not talk about the difference in real estate costs, but when you note that first class underground cable may cost eleven cents per foot and may be pulled into a duct costing 25 cents per foot; while the cost of an equally conducting overhead wire in position, including poles and cross arms, may not exceed 2½ cents per foot, you will at once appreciate the importance of one factor of differentiation. Another item which counts is the ornamental lamp posts which are largely used in the down-town streets of large cities. These vary in cost from $30 to $50 set up. The Detroit down-town lamp posts cost $50. The extra pole, span wire and hanging device for a street lamp in a village will not cost more than $10.

But the factor of depreciation is that concerning which there is the greatest dispute. I don't know why there should be such dispute. It seems to me that an honest inventory and valuation made at the end of each fiscal year would be the proof or disproof of each and every theory. Such inventories are made regularly of many electric lighting properties. Such inventories are an annual duty of the management of most manufacturing corporations. Indeed, what is the yearly stock taking of the corner grocery store but an inventory and revaluation? And, what would you as business men think of the manufacturer of or the grocery man who told you that he estimated a depreciation of his stock at 3 or 5 or 10 per cent. and figured thereby that he had made a certain profit on his year's trading? You would ask for his inventory or his machinery ledger very quickly.

The difference between the corner groceryman and the electric lighting company or the municipal lighting plant is only in degree and not in kind. If property and equipment is not worth this year what it was last, the difference must be made good before either a showing of a profit or a statement of cost of doing business can be truly made. Therefore, I cannot accept as complete any statement as to the operating cost of a public lighting plant unless it shall be accompanied by a competent valuation of the property and apparatus owned by the plant. The history of the electric lighting business is strewn with records of failures due to neglect of this primary requirement of good business. In Detroit the first organization to do public lighting was finally sold for 25 cents on the $1 of investment in spite of the fact that its books showed a profit for every year of its operation. The stockholders came out with a loss after believing for years that they were earning a profit. The public lighting plant of the city of Detroit is sending out annual reports which estimate that the depreciation of its property is 3 per cent. annually, while the commissioners in charge of that plant have entered on a policy which will shortly put on the scrap heap every dynamo and arc lamp originally owned by it. The wiping out alone of these two items of investment will go far to absorb the entire depreciation charge made since the beginning of the plant, leaving nothing for the inevitable deterioration of the remainder of the equipment. The mistake is just the same in the one case as in the other. The demonstration of the mistake can only be made by a reversion to common sense business methods.

Instances of small depreciation as well as instances of excessive depreciа-

tion can be found to support almost any theory. Variations in practice, in local conditions, in skill of management have had more effect in the electric light industry than perhaps in any other industry which has arisen in the United States. I have known plants in which 3 per cent per annum honestly paid into bank at compound interest would have made good the depreciation for perhaps 10 years. I have seen other plants in which the entire investment was wiped out in less than four years—at the rate of 25 per cent per annum. A plant which I think is fairly representative has by actual showing been compelled to expend an average of 8 per cent. per annum over a term of 12 years in order to maintain unimpaired the investment of its stockholders. With such variations in the personal knowledge of one man you will see that it is easy to get an illustration of almost any estimated depreciation, but you will also see (and I hope remember) the absolute necessity of frequent revaluation of street lighting properties.

The third part of this subject is by request a reference to 'Municipal Ownership of Street Lighting Plants."

I suppose it is because of my experience under both municipal and private ownership that an expression of opinion from me on this subject is worth asking for.

My opinion is that there is no general reason why a municipality should not successfully own and operate its own public lighting plant. It is possible to take each case of municipal ownership and to say definitely why it is successful or why it is a failure, as the case may be; and in each and every case the cause of the success or of the failure is local. It is even possible to take instances of failure turned to success and of success turned to failure and to assign the local reason for the change. And without exception in the final analysis success has been due to the personality of the man or men in control.

When you find a capable electrical engineer giving his time to the management of a municipal plant either by reason of his public spirit or because he is paid a sufficient salary; when you find that this man controls the plant and the employes thereof free from interference of well meaning blunderers as well as of self-seeking politicians—there you will find a plant which is making a record creditable to municipal ownership. Under contrary conditions the failure is inevitable. It makes little difference whence comes the interference with the engineer who should control the plant and who should be held responsible for results. A politician who has an axe to grind or a heeler for whom a job is wanted is not one whit more detrimental than is the excellent intentioned commissioner who has been to Boston—or some other seaport—and has seen dynamos driven by motors and who insists in and out of season that in the motor drive lies the only way of salvation. Or who, having read, marked and inwardly digested the advertising matter of a manufacturer making a new kink in arc lamps (or it may be of automatic stokers) nags the other members of his commission until they let him try his momentary fad at the expense of the public. That sort of a man sometimes appears in the directory of an electric lighting company but he does not last long. His associate directors are much less acquiescent when the money they are spending comes directly out of their pockets and not from the tax levy.

I think that when our citizens will take as much interest in the affairs of the municipality as they do in the affairs of the corporation in which they hold stock municipal ownership will inevitably succeed. Remember that the intelligent stockholder is not by any means the man who worries his directors and manager constantly about matters which he does not understand. The truly intelligent stockholder is the man who, having to the best of his ability selected good directors and a good manager, lets the men so selected severely alone and looks to them only for results.

Which, being otherwise stated, resolves itself into the truism that an enlightened public spirit among citizens at large is the sine qua non of perfect municipal government.

The foregoing is my expression of opinion as to the possibility of successful municipal ownership. The advisability even of success on such lines is a problem on which I am not yet ready to express myself. I, like many others—like some of you—and still more like your sons, who are growing up—find that individual opportunities are already none too numerous. I question whether it is well that any industry which has grown rapidly under the stimulus of individual interest should be changed over to that condition where the bondholder who is protected by the entire wealth of the municipality should be substituted for the stockholder whose individual savings are invested in a local enterprise; or where the municipal officer with fixed compensation and with unfortunately too little prospect of promotion should take the place of the active manager who feels that his annual accounting to his interested stockholders will bring him promptly the approbation and the reward which he has deserved.

ELECTRICAL GOVERNMENT.

Austin S. Hatch, Detroit, Mich.

Regulation. The duties in the line of regulation are those controlling construction, maintenance and operation of public utilities. In construction the principal subjects are location, designation and interference. Designation is a simple rule to enforce, simply a different style of insulator, a stamp on the crossarm or cable will indicate whose wire and for what purpose it is used; this rule with the proper distribution of services will save a vast amount of trouble.

The regulation of maintenance undoubtedly requires the most diligence. Seeing

A. S. HATCH, DETROIT, MICH.

that a company keeps up its lines to the safety and well being of the city is a disagreeable duty in both small and large cities, since in small cities the company seems to think it is doing the city a favor rather than the city is helping them, and in large cities there is generally more than one company and each is watching the way you are treating the other fellow and trying to do as little as possible in repairs in the way you want it done. This duty undoubtedly has the greatest opposition even to opposing legislation to enable the rule to be enforced.

The regulation of operation is principally in connection with testing both city and private service, and the right of way for city wires on private poles and in private conduits; this latter clause should be particularly liberal since the life of a city depends on the perfect working of fire and police lines.

Interference. While this is one of the duties of regulation, I have thought it important enough to be taken as a distinct heading with the duty of location which it includes. The first company always has the right of way and decisions must be made in its favor in any controversy between companies. However, there is a modification to this rule, and that is in case of neglect on the part of both companies. One case has come to my notice illustrating this distinction.

A supreme court has decided a case brought against two carrier companies jointly, one being a telephone and the other an electric light, by a person severely injured on account of the telephone wires coming in contact with the electric light wires. The telephone line was constructed first, consequently the electric light company took the privilege of occupying the streets subject to the fact that the telephone wires were there crossing its route. The court decided that both companies were responsible because every person using the highways is bound to exercise reasonable care to protect others from harm through his use. In case the use is continuous, the degree of care required will not be governed by the condition of the highway at the time the use began, but will change as that condition changes, and must keep pace with the circumstances as they occur.

Another case is where a city was held responsible for the killing of a boy from a private telegraph line falling across a trolley wire. The court held that the city allowed the wire, which was a dangerous element, to remain in the streets and consequently was liable.

One common law of carriers is to so construct and maintain improvements that they will expedite their own service, resulting directly in the improvements instituted in cities as compared with the country, paved streets, sewers, shade trees, etc., so we must view electrical improvements in the same light. It must not hinder other carriers nor mar the beauty and improvements of a highway and this is where the city electrician's knowledge should be exercised. Common interference on the part of all companies is in the use of the highways so as to deter or hinder the operation of one another in a proper and safe carriage.

Cities realize the importance of such a law, so some official usually has the disposition of poles and in some cities of wires also. This officer should be the city

electrician, since in many cases any other person would not be aware of the real reason which is often behind a permit to set a pole in a certain place.

Probably the most important line of interference at present is that due to electrolysis, since it is not immediate in producing effects. We are particularly careful concerning the electrical wiring of buildings for fear of fire, but there is not near the danger from defective wiring as there is from defective pipes because it is not one class of piping affected but all. The bursting of these pipes does not result in a cessation of service only, but in defacement of the streets and even destruction of buildings. Pages have been written and suits brought to stop this trouble, but I believe close vigilance with prompt action on the part of both the city and the railroad company will prevent it. The city electrician cannot put his "spare" time to better advantage than in measuring the potential between track and hydrants and keeping a tabulated record of the tests. If you cannot get a low reading voltmeter that will measure such a current, make one, if with nothing more than some fine wire and a pair of sewing needles. The remedy is to keep the current from the pipes and this means aggressive work on the part of the city and a little capital on the part of the company. The proper time to stop it is, like other bad habits, before it begins.

The most disagreeable interference to contend with is one seldom thought of by a city official, that is induction. This is purely an electrical effect caused by the variation in the strength of current in a wire, which produces a current in a neighboring wire to the hindrance of the proper working of that wire. This can always be controlled by the proper arrangement of the wires. It particularly affects telephone service and so is a menace to fire and police patrol in interfering with their telephone systems. Incandescent lighting gives no serious trouble, but motors and series arc lighting on alternating systems are very annoying. The remedy is in metallic circuits on the part of the telephone lines and having lead and return run parallel in the electric light lines.

Tree trimming is a duty not often thought of by the city electrician unless he has a plant to run. This is not such a difficult task if care is taken in trimming the whole tree instead of just room enough to clear the wires. Probably the best way to cear wires is to run through alleys as much as possible.

STATE WATER SUPPLY IN NEW YORK.

George W. Rafter, Rochester, N. Y.

I desire to call your attention very briefly to some of the possibilities of state water supply in New York which may be defined as a water supply reserved by the state for the exclusive use of its cities and towns. New York state is especially suited for such reservation because it is possible to deliver water by gravity, without excessively long conduits, to practically all the cities and towns of the state.

If we examine a topographical map of the state, we observe that there are six high points, which may be denominated water centers—points from which the water flows in all directions. The larger and more important of these is the elevated region known as the Adirondack mountains, or, for present purpose, the Adirondack center, the highest peaks of which rise to an altitude of over 5,000 feet. The second water center, or Catskill mountains, in the southeastern part of the state, where the highest points rise to an altitude of over 4,000 feet. The third water center, which may be called the Allegany center, is the elevated region in the southwestern part of the state in Cattaragus, Allegany and Steuben counties, where the highest points are at an elevation of about 3,000 feet. The fourth, or Rensselaer center, lies east of Troy and Albany, and its highest altitudes are over 3,000 feet. The fifth, or Chenango center, is west of the Catskill mountains, with an elevation of over 2,000 feet. While the sixth, or Lowville center, is to the north of the Oneida lake, with an extreme elevation from 1,500 to 1,800 feet.

The Adirondack is a rugged region, consisting of primeval granitic rocks, interspersed with sand areas. Here appeared the first dry land on the Western continent and thus was laid, in the earliest geological time, the basis of those fine river systems which, issuing from this water center, have created water resources of vast value to the citizens of New York. From this center, water may be supplied to Plattsburg, Malone, Canton, Potsdam, Ogdensburg, Utica, Herkimer, Johnstown, Saratoga, Schenectady, Lake George, Albany, Troy and many

other large towns of the region, all within practical distance of the purest water, flowing from granitic watersheds with a population not exceeding eight to fourteen per square mile. This region is also extensive enough to furnish abundant supplies to the cities of the Hudson valley. In 1900, the writer presented a report to the Merchants' association of New York City showing that 500,000,000 gallons per day could be taken to New York without even drawing upon the capacity of this region.

The geological history of the Catskill and Allegany water centers is quite different from that of the Adirondack center. In both these regions the sedimentary sandstone rocks of the Catskill and Chemung groups have attained their greatest development. In the Catskill mountains these rocks are still practically horizontal, as originally deposited, and in places, several thousand feet in thickness. Limestones and other hard rocks, underlaid by shales and soft formations, are found beneath the sandstones on a lower stratigraphical horizon.

From the Catskill and Rensselaer water centers, water may be taken to Albany, Troy, Hudson, Catskill, Kingston, Schenectady, Newbury, Goshen, Monticello, Delhi, Cooperstown and other large towns of the surrounding region.

From the Chenango center, water may be taken to Norwich, Cortland, Binghamton, Oswego, Syracuse, Utica, Auburn, Waterloo, Geneva and other places nearby.

From the Lowville center, Lowville Watertown, Carthage and Oswego may be reached.

From the Allegany center, Buffalo, Lockport, Albion, Batavia, Warsaw, Rochester, Geneseo, Angelica, Bath, Corning, Elmira, Canandaigua and Lyons may be reached.

In the course of making projects for large storage reservoirs, on Black, Salmon, Mohawk, Hudson and Genesee rivers, the writer has had occasion to consider every possible phase of water supply and in view of the vast increase of population for the last one hundred years in New York state, he cannot but think that the time has arrived when the state should make provision for retaining the headwaters of the streams issuing from these several elevated regions, as a future water supply for the inhabitants.

The population of New York state in 1800 was 589,051. In 1900—one hundred years later—it was 7,268,894. In the year 2000—another one hundred years—it is difficult to predict what it will be, but assuming a reasonable increase, it is not unlikely that the population may be 50,000,000, or at the rate of 4,000 on every square mile of the state. When we have such a population, a public water supply will be indispensable in about every highway in the state. It is obvious, also, that the water supplies of the present day would be a mere drop in the bucket and the only way that appears feasible is that the state, by its sovereign authority, set aside the headwaters of the streams issuing from these main water centers, as perpetual water supplies, to be kept perfectly pure, and drawn upon as needed. In this way, Lakes Erie and Ontario, the ocean and the larger rivers of the state, may be left free for sewage disposal, without harm or offense to anybody.

The state has, indeed, already done something on this plan, by the purchase of lands in the Adirondack and Catskill water centers. These purchases should be continued in other water centers, somewhat as indicated. Undoubtedly, at some time in the future, this matter will be subject to consideration by a state commission, specially authorized to take into account the various engineering, legal, forestry and other questions which may properly come before it.

The writer indicated some of the more obvious duties which may be likely to fall upon such a commission, drawing somewhat upon an act proposed a few years ago in New Jersey, largely the work of the late Lebbeus B. Ward, M. Am. Soc. C. E.

REPORT OF COMMITTEE ON STREET PAVING.

Nelson P. Lewis, Chairman, New York City.

After looking over the program and noting the list of papers offered by your committee on street paving, you may have commented upon the fact that roads, rather than city street pavements, are to receive the greater part of the time devoted to this general subject. Nor does your committee think it necessary to excuse itself for adopting this course. If you will examine the reports of the conventions which have already been held you will see that the papers have been devoted almost exclusively to the consideration of permanent and expensive city pavements. No less than forty-six papers have been presented by the com-

mittees on street paving and quite fully discussed by the society. These papers may be classified as follows: Seven have been devoted to the general subject of street pavements; thirteen to the construction and repair of asphalt pavements and the testing of materials used in their construction; nine to the consideration and maintenance of brick pavements, specifications for same, and the testing of brick; five to wooden block pavements; three to the subject of railroad tracks in paved streets; two each to stone pave-

NELSON P. LEWIS,
Chief Engineer B. of E. & A., New York City.

ments, and openings in paved streets and regulations governing the same; and one each to tar in bituminous pavements, foundations for pavements, curbing of streets, bicycle paths, and the question of damages for non-repair of highways. The printed proceedings will show that most of these subjects have been freely and intelligently discussed, so that the society reports form a very valuable contribution to the literature of the subject.

You will notice that little attention has been given to the improvements which are of most interest to the smaller cities and suburban districts where permanent and costly pavements are out of the question, while the subject of interurban roads has not been touched upon. In these days of expansion and consolidation we hear not only of a Greater New York and a greater Boston, but of a greater Rochester, a greater Newark, a greater Troy, while the future is big with the possibilities of a greater Oshkosh or a greater Kalamazoo.

Whenever suburban districts are added to our cities there is immediately presented the problem not only of maintaining such improved streets or roads as the new territory may possess, but the extension of those improvements on a scale suitable to the needs and requirements of the community. The urban resident, too, is not content to be limited to the paved streets of his own town and to flounder in a sea of mud or be covered with dust whenever he attempts to leave them. He wants good roads leading out into the country on all sides, while those who supply his table with garden produce must have good roads on which to transport it. The prosperity of a city and the comfort of its citizens can be truly said to depend upon the character of the highways leading out of the city as well as upon that of the street upon which he lives or those which he traverses in his daily duties.

It is time, therefore, that the subject of roads, as distinguished from city streets, a subject which has thus far been neglected in our meetings, should receive the consideration which its growing importance merits. The building of a system of roads to connect different cities and towns, if left to the initiative of the towns themselves, would be almost impossible of consummation. The state alone is capable of planning and executing such an improvement. It is advisedly called "an improvement" for it should be complete in itself and result in unifying the commonwealth as nothing else could do. The first state to take up this question on an extensive scale was New Jersey, which has now a splendid system of highways connecting nearly every city and village within its borders. Massachusetts has, for some years, been creating an excellent system of modern roads, and in a manner characteristic of the old Bay State, her highway commissioners are doing their work with exceptional thoroughness, giving much attention to details of grade, alignment, drainage and the general appearance of the roadside. During the last few years New York has devoted much attention to the subject of roads and many miles of fine highways have been built and are under construction.

Your committee is fortunate in having prevailed upon the chairman of the highway commission of Massachusetts, and the state engineer of New York, to de-

scribe to you the work done in their respective states. Both of these gentlemen have done much not only to promote an active interest in good roads, but to demonstrate how good construction can be attained with the materials at hand.

It will be seen that the propaganda which may fairly be said to have been started by the bicyclists a few years ago has been steadily gaining ground. The automobile is now an important ally of the good roads advocate, and the sane driver of the horseless vehicle who has some regard for the rights and safety of his fellows can add a great impetus to the movement, though at least one instance has come to the notice of your committee where a proposition to bond a town for the purpose of building several modern highways was defeated by popular vote solely as a result of accidents caused by the outrageous disregard of the safety of the general public shown by the drivers of high-speed automobiles. These high-speed cranks are the worst enemies of the good roads cause.

But the building and maintenance of macadam roads is not only of interest to the small city and the good roads enthusiast. Many of our larger cities have miles of their streets so improved, and they are, as a rule, grossly neglected, while such repairs as are made are carried out in an unintelligent and extravagant manner. According to the bulletin issued by the United States Department of Labor in September, 1899, giving statistics of cities, 140 cities containing over 30,000 inhabitants have over 82,000,000 square yards of macadam, which is equivalent to more than 4,650 miles of roadway thirty feet in width. The proper building and intelligent care of such roads, therefore, cannot be a matter of indifference to our larger cities, but it is one of the most vital importance.

THE WORK OF THE NEW YORK STATE HIGHWAY COMMISSION.

Edward A. Bond, State Engineer, Albany, N. Y.

Up to the present time the state has appropriated for the building of highways under the Higbie-Armstrong act $1,465,000, and this money has been expended in the construction of 121 roads in twenty-three counties of the state, covering 355 miles. In addition to the money already appropriated by the state, on Oct. 1 nineteen counties had voted their half of the money for the construction of an additional 214 miles of road, half of the cost of which was estimated to be $834,727.50, making a total of 177 roads in twenty-four counties, covering 569 miles. It is my belief that before the adjournment of the next legislature the amounts voted by the different boards of supervisors of the several counties of the state will reach $1,500,000.

Up to the present time the states which have shown the most activity in the permanent improvement of highways are Massachusetts, New Jersey, Connecticut and New York. By the latest annual reports at my command, I see that Massachusetts has constructed 480, New Jersey 642 and Connecticut 108 miles, making a total of 1,230 miles for those three states. The true valuation of these states is five billions of dollars, as compared with New York's valuation of eight and one-half billions.

The state of New York has an area of upward of 50,000 square miles, within which there is roughly estimated to be 75,000 miles of highways. By careful analysis of the situation, it has been found that about one-tenth of the highways are what would be termed important thoroughfares or those which should first receive permanent improvement.

For the last half of the past century our minds have been occupied by the construction of a complete system of railroads throughout all the states of the Union, and the building up of large manufacturing interests of various kinds.

The highest type of mental culture and development throughout country districts cannot be obtained without means of easy and rapid communication. There is no doubt that the railways and telegraph are the great modern civilizers of the world, and up to the present time have done more than any other one thing to permanently hold this nation together, but they are limited in their spheres of usefulness, because they do not reach the farm, the home, the country school house and the church. The common road is the connecting road between these. Without this good road the progress of widespread civilization must of necessity be greatly retarded.

The rural free mail delivery which is becoming so popular throughout the whole country would be extended by reasons of better roads. The greater part of New York state is so diversified and beautiful

in natural scenery and surroundings that not only the wealthier classes, but also the people of moderate means, are led to select homes in the country and make them permanent; and no one thing tends more to increase the beauty and comfort of a rural home than a perfect highway which can be traveled through storm or sunshine with perfect safety, either by the ancient horse and shay, or more modern turn-out of the well-to-do merchant or successful farmer, to say nothing of the indispensable bicycle or the elegant automobile, whether the latter be a "White Ghost" or a "Red Devil."

My belief is that the time has passed when we need to cultivate public sentiment as to the necessity of improving the roads of our state. We have now reached a point where it is necessary to devise the ways and means for constructing them. In the last supervisors' annual convention held in Albany, the advisability of issuing bonds of the state for the construction of the highways was thoroughly discussed and it was unanimously voted that it would be advisable to bond the state for $20,000,000.

It was shown at this convention that $10,000,000 would provide for substantially 1,250 miles of macadam highway and, on the basis of completing one-tenth of the roads in the state, namely, 7,500 miles, distributed throughout the several counties, an expenditure would be required of $60,000,000 within the next six or eight years, in the improvement of the highways of the state of New York. This expenditure would, in the opinion of many, be of greater benefit to all of the people than an equal expenditure of money in any other direction that could be named.

I predict that within the near future the money required for the annual expenses of our state government will be met by indirect taxation, leaving for the improvement of our public highways all of the income derived by the state from the excise money. This would give a fund of from $4,000,000 to $5,000,000 per year to expend in improving the highways of the state without creating any debt, and it has been suggested by wise statesmen that it would be well to amend the laws so that a given portion of this money could be expended within the limits of the incorporated cities and villages as well as in the rural districts, thus providing for continuous pieces of improved road throughout all sections of the state, the benefit of which can be enjoyed by the present generation.

But, until the highway law of our state is so amended, we can with safety and properly proceed under the Higbie-Armstrong law, which has many features that commend it to the public. The first movement is made by the people, in petitioning for the improvement of any particular highway desired, passing from them through their board of supervisors to the state. After careful investigation, surveys and estimates are made and the plans returned to the people through their boards of supervisors for final action, all of which fosters the much-desired principle of home rule and insures economy and careful management throughout the whole process.

This act has not only met with great approval in our own state, but it has been so highly commended by the office of the public road inquries of the depart-

EDWARD A. BOND,
State Engineer, Albany, N. Y.

ment of agriculture, at Washington, that numerous requests have been received from other states in the union, which are now for the first time taking up the subject of highways improvement, asking for copies of the law and an explanation of its workings; and, in several instances, I have been informed that it is proposed to adopt the general provisions of the law in many of these states.

One of the most encouraging features connected with the subject of highway improvement, and one with which I have been deeply impressed, is the fact that its importance seems to be so fully realized by all classes of our citizens. The cry for good roads comes not alone from residents of rural districts, but from all classes and conditions of men.

In answer to questions it was stated that most of the improved roads in New

York radiate from cities as centers such as Buffalo, Rochester, Utica, Albany, except that in Westchester and Putnam counties there are two roads which are pushing on to make through lines. The Higbie-Armstrong law works well because it acts locally and produces this radiating effect. The fact of the petition demonstrates the value of the road in practically every case.

THE WORK OF THE MASSACHUSETTS HIGHWAY COMMISSION.

W. E. McClintock, Chairman, Boston, Mass.

The area of Massachusetts is 8,000 square miles. The state has 20,000 miles of roads, of which 18,000 miles are in the towns. The population of the state is 2,250,000, and the property valuation is $2,500,000,000. Sixty-seven per cent of the population and property value is in the cities. The value of the agricultural products is $50,000,000, and the manufacturing interests are estimated to be worth $1,027,000,000.

The whole seashore district and the Berkshire Hill district are given over to summer travel and summer residences, and whatever is done in good road work will increase travel and the number of visitors to the resorts and thus enhance the value of the land. Besides, the construction of good roads will lead to the re-establishment of small water-power stations that have fallen into disuse. This is already being accomplished. The farmers of the state send their products to be prepared for the market at these small industrial plants. The latter thus secure their raw material at first cost, the selling price of the manufactured article is less than otherwise, and all reap the benefit.

Massachusetts has now 480 miles of state road built. It has been built at a cost of $4,400,000, of which $200,000 has been expended in buying machinery for the towns and for the maintenance of the roads. The roads were built at an average cost of $8,200 a mile. The cost a mile has varied from $2,000 to $25,000. The cost of maintenance, which is met by the state up to $50 a mile, is $100 a mile each year.

The state roads have been built of broken stone or gravel. The source of supply, the weight and volume of the travel and the character of the subsoil have been carefully studied and the road has been made to meet the physical conditions and the demands of traffic.

Besides the roads built by the state, the towns have built at their own expense in the last eight years 500 miles of road. These roads are as good as those made by the state and have been built in the same period required to construct the 480 miles of state road. The towns, however, were stimulated to action by the measures taken by the state. Opposition to the improvement of roads has practically ceased.

The method of execution of the work was described substantially as follows:

The location and construction of the state roads is in the hands of the state highway commission, one of whose members is an engineer. Hearings are given on petitions, at which the roads to be built each year are selected. This selection is made in the spring and money is allotted to each county according to the judgment of the commission. Extensions of existing improvements are usually made so as to make the roads as nearly continuous as possible.

Next follow the surveys. There are five division engineers to look after road construction and maintenance and to advise the road supervisors. The surveys consist of levels and cross sections. The grades are laid out on profiles by the engineer on the ground so as to fit present good sections of road as nearly as possible and to require the minimum of work.

Unless the town decides to take the work itself at the price bid it is let to the lowest bidder. Half the time the town takes the contract, uses home labor and gains experience of use in future construction and repair.

In the past eight years the towns have built over 500 miles from their own appropriations in addition to those built by the state. Forty per cent. of the appropriation must be set aside for towns of less than $1,000,000 valuation. Some of these do not then get more than $100 to $150 a mile of their road length.

The methods of construction were then described. First as to drainage. Subdrains are used where needed, but only there. In clay they have outlet in culverts or water courses. Their depth is three feet. The vitrified pipe used, with open joints, is surrounded by fine gravel and the trench is filled with coarse stone. In cuts drains are put on both sides of the road, elsewhere on the upper side unless needed on both sides. They are

always used in clay, never in gravel or sand, sometimes in sandy loam. If there are failures on account of omission of drains they are inserted. Surface water drains, conduits and culverts are constructed as needed and all are included in the cost of the road. Much care is taken in deciding form of ditches along sides of roads.

As to foundations. The English experience with Telford foundations is reported unsatisfactory. The foundation stones sink into clay and their points are projected by frost action above the surface. Massachusetts puts a course of gravel on the clay as basis for the Telford and broken stone layers. In four or five years a new surface is needed. The Telford acts as an anvil for crushing the surface layer under blows of traffic. It is being discarded in favor of gravel, of which nine or ten inches serve the same purpose. The depth is changed as the subsoil requires, the method of computation being that the square of twice the depth of the broken stone or gravel divided by the weight on one wheel shall not exceed three or four, the assumed bearing power of the clay in pounds per square inch. The sub-grade is thoroughly rolled with a steam roller. Then the gravel is put on and the broken stone of the first course. This is rolled and the wearing surface is put on according to the traffic. The broken stone is screened through ½, 1¼ and 2½ inch screens. The large stones, 2½ to 4 inches in size are put on the bottom as it is shaped and rolled. The top layer is made of stone ½ to 1¼ inches, the lower course 1¼ to 2½ inches, the total depth being 6 inches. The surface is evened up with stone of the same size. The whole is then covered with screenings less than ½ inch size. No water is used until the screenings are put on. The surface is then thoroughly watered and rolled, forcing the screenings into the stone. Bare spots are covered, watered and rolled again, until the dust and water flush to the surface. Gravel is sometimes used, sized in the same way as the broken stone. If hauled more than two miles it costs more than broken stone with less haul than two miles.

Machinery—The crusher is set to run the stone through without handling after it enters the hopper. A portable crusher costs $1,600 and ten horses can haul it from place to place. Two rollers are owned by the commission for loan to towns. The state work is done by contract.

Cost—The average cost per mile of road in Massachusetts is $8,200. This includes everything from grading bridges and materials to finished road. The state pays $6,000 of the cost and the counties the remainder. The roads cost more than in New Jersey for several reasons; the labor day is nine hours, the average wage is higher; in all 30 per cent.

Repairs—The division engineer goes over every road in his division once in two or three weeks. He orders the repair men to make the repairs. The repairs are let by contract, some at $50 per mile per year. In one case the man has eleven miles. This payment is for the time of the man his horse and tools, the state furnishing the road materials. Some of the roads are two years old and some eight. The roads are repaired continually until they are worn thin, when the surface is broken up with roller spikes and a new top of ½ to 1¼ inch stone is put on.

In answer to questions it was stated that the thickness of broken stone varies from 4 to 6 inches, one road having but 3 inches. The total thickness varies from 6 to 24 inches. Side drains are of glazed bell and spigot pipe with open joints, with 2 inches of broken stone underneath, fine gravel around and over, located 3½ feet below the top of the road. They are from 5 inches up to 10 inches or more in diameter and cost from 25 to 40 cents a linear foot. There is no frost action on on them at this depth.

ROAD AND STREET IMPROVEMENTS.

Emmet A. Steece, City Engineer, Burlington, Ia.

No subject has received more attention than that of the system of communication by means of wagon roads. In the intermediary between the wet, sticky gumbo, which adheres to the wheels of vehicle in such masses as to cause them to be dragged rather than rotate, and the "beau ideal" asphalt paved city street there are as many different kinds and conditions of road and street surfaces as can be imagined.

Earth, brush, corduroy, plank and wood block streets were briefly considered the life being estimated at a week of 30 teams a day for brush, 8 years for corduroy, 5 years for wood or block 30 feet feet wide, 1,000 vehicles a day, or 7 to 8 years with 300 vehicles a day.

The broken stone road is a product of common sense and is as well known, divided into two classes, small broken stones throughout and large stone base with finer stone surface On steep grades the effect of surface water is as damaging as the wear from vehicular traffic. If a traffic of 300 vehicles a day is confined to a narrow space, for instance 8 feet, on either side of a railway, a 4 inch top is completely cut through in about 3 years and where the traveled space is about 16 feet the wheels cut through the top in about 10 years.

Any broken stone improvement ending

EMMET A. STEECE,
City Engineer, Burlington, Iowa.

in or crossing mud roads is greatly injured by being literally picked up by mud covered wheels and deposited in heaps, leaving the surface in waves. The cost of broken stone pavement depends largely upon local conditions, amount of stripping at the quarry, kind of stone, method of quarrying and breaking, distance from the quarry to the work, and above all the last item should receive consideration first, as with bad management money evaporates, leaving poor work and little of it done. The average cost to the contractor of macadam road without excavation, metal 12 inches thick, is from 40 to 50 cents per square yard. distance one mile from the quarry; in detail as follows:

Quarrying, stripping not included: Hand drilling 22 cents, common labor 20 cents, explosives and repairs 3 cents.

Crushing: Load and hoist 5 cents, feeding crusher 4 cents, engineer and helper, 4 cents, repairs 3 cents, fuel and incidentals 5 cents.

Paving: Haul 1 mile 35 cents, spreading 9 cents, rolling with steam roller 17 cents.

The cost of Telford pavement does not differ materially from that of macadam, the larger stone being set on edge at about the same price as breaking and spreading. A seventeen and one-half ton steam roller will consolidate from 25 to 30 cubic yards per day of ten hours. A layer of broken limestone 10 inches thick when loose will roll to 8 inches; a 4½-inch to 3 inches, and about 4 inches of screenings will be required to fill the interstices of the top course.

The cost of stone pavements well laid with a foundation of concrete will be more than asphalt and last no longer and not so agreeable to traffic as the latter. Soft limestone as usually laid lasts about 15 years under a traffic of about 1,000 teams per day on a roadway about 20 feet in width, when it becomes so worn as to become a nuisance, while granite when laid properly will be in better condition in the same length of time under a traffic of 25,000 vehicles per day.

Though the work done in the cities in the last two years shows a slight reduction in the extent of brick pavement construction, yet that class of material can be called more strictly modern than the others, and rank with any as to first cost and durability, the cost being largely influenced by competition and availability of material and the durability by the method of construction. Formerly bricks were laid down without apparently considering the foundation; one course on sand alone, or loose broken stone, or two course work; but these methods have gone into disuse, and concrete of varying thickness to suit the conditions is now the accepted method. The cost of labor for brick pavement is about as follows under ordinary conditions:

Concrete work: mixing, 40 cents; wheeling 200 feet, 20 cents; leveling and tamping, 15c; total 75 cents per cubic yard or about 12½ cents per square yard, 6 inches thick. ,

Brick laying: leveling, ⅓ cent; wheeling brick, 2 cents; laying, 1½c; tamping, ⅓ cent; patching, ⅓ cent; total, 5 cents. Concrete included, 17½ cents for labor alone. The labor on two-course brick cost about 7½ cents per square yard. Laborers' wages at 15 cents per hour.

The cost in either case is slightly modified by varying local conditions, for instance, rolling with two-horse roller reduces the cost of consolidating to 1-3 cent, and rolling the sub-grade increases

the cost by 1 cent. Also in the concrete work by properly placing the materials, the cost of labor and transportation can be reduced to 40 cents, total.

Asphalt paving hardly comes within the province of this article, requiring more capital and experience to handle successfully than brick, stone, etc. The cost of labor in laying asphalt, exclusive of original investment, is from 4 to 5½ cents per square yard, for the pavement proper and the same as other pavements for foundation, the greatest variation in cost aside from competition being caused by the length of the guarantee.

THE DEVELOPMENT OF THE BITUMINOUS MACADAM PAVEMENT.

Fred J. Warren, Boston, Mass.

As explained in a paper read before the Boston Society of Civil Engineers early this year by the writer:

"The principle on which the bituminous macadam pavement wearing surface is combined, is the reverse of the principle on which the ordinary asphalt pavement is built. In the present asphalt or tar pavement the bituminous cement is used to support fine mineral grains, such as sand, which in themselves have no firmness to sustain traffic, in such a way that the fine mineral grains will be held or supported by the bituminous cement so that the mortar or mastic will, at all atmospheric temperatures sustain the weight of traffic, and, at the same time, resist abrasion. The bituminous macadam is built on the principle that, independent of the bituminous cement, relatively coarse and fine mineral grains should be combined in such a way as to have a firmness in themselves, to sustain the weight of traffic. The bituminous cement is supported, or held in place, by the proper arrangement as to size of stone particles. The bituminous cement is used solely for the purpose of preventing attack on the stone from water and weather, and to bind the particles together sufficiently to prevent abrasion from traffic at all atmospheric temperatures and, at the same time, provide an elastic bituminous cement or cushion between the mineral particles which will deaden the jar and prevent the wearing effect caused by friction from the movement of its integral parts. The life or efficiency of either pavement depends largely upon the skill and care with which the various elements of the wearing surface are selected and combined.

Something over two years ago, after an experience covering a period of twenty years, in the refining of asphalt, manufacture of bituminous cement and the laying of asphalt pavements, the idea occurred to one of the Warren Brothers that by combining the essential principles of the most improved asphalt or bituminous and the most improved macadam pavement, a result could be reached which would give a pavement with greater durability than asphalt, provide a foothold for horses equal to macadam, and, at the same time, maintain the relative or general smoothness of an asphalt surface and overcome the necessary muddy or dusty condition of macadam, providing a pavement that, while having the density of solid stone, would have great elasticity.

The theories on which the construction is based are:

First. That, with a solid, well rolled sub-foundation, a thoroughly rolled base of crushed stone, such as is used in the most improved macadam pavement and joined with bituminous cement, is practically as good as any foundation.

Second. That, with a rough crushed stone base, coated with hot bituminous cement and a scientifically prepared wearing surface of bituminous concrete made of crushed stone and bituminous cement, shifting or rolling can be overcome. The shifting is due to two principal causes, rolling on the smooth concrete base and rolling on each other of the particles of fine sand use in the wearing surface of the ordinary asphalt pavements during hot weather when the bitumen or asphalt is in a semi-plastic and fluid condition. This tendency to shift limits the amount of bitumen which can be successfully used in an asphalt pavement to 10 per cent. or less.

Third. That by using for the mineral aggregate of the wearing surface angular particles of the hardest available crushed stone varying in size from about two inches to an impalpable powder in such proportion that the succeeding sizes will fill the coarser voids in the larger sizes, a far greater density could be secured than had previously been attained in either macadam or asphalt pavement construction. To secure the best results it is essential that the crushed stone after heating be separated into several sizes and then mixed by machinery in definite proportions by weight.

Fourth. That, by increasing the density and thus decreasing the voids, and, by

having the bulk of the mineral aggregate composed of coarse angular particles of stone, the voids can be thoroughly filled with bituminous cement, and, by using a bituminous cement which is unaffected by water, a thoroughly water-proof wearing surface of bituminous concrete can be produced.

Fifth. That particles of carefully selected, crushed, hard stone held firmly in place by an elastic bituminous water-proof cement, would provide, for the wearing surface of a pavement, one of the most durable substances known and a sufficiently rough surface to give an ideal foothold for horses.

In inverse ratio, the percentage of voids

FRED J. WARREN,
Pres. Warren Brothers Co., Boston, Mass.

in the mixture of different sizes of stone used, indicates its density or specific gravity. Uniform sized particles of any shape or size contain approximately 40 per cent. of voids, ordinary sand contains 30 to 38 per cent., very seldom as low as 30 per cent. The most carefully prepared mixture of several grades of sand used in the most modern asphalt pavement mixture contains 25 per cent. of voids. The use of graded stone reduces the voids in the mineral mixture and the rigidness of the stone permits of the use of a softer and therefore more durable bituminous cement than can be used with sand.

It is owing to minimizing the exposure of the bitumen and the use of a softer bituminous cement, which would require more exposure to render it inefficient, that it is believed the cement itself will retain its binding or cementing properties longer than would be possible in sand mixtures.

By using crushed stone varying in size from a maximum of two inches to an impalpable powder in exact proportions, as above described, we are able to reduce the voids to 10 per cent., and, by using enough of the bitumen to thoroughly coat all the particles and fill all the voids, can get a thoroughly waterproof wearing surface. We do not mean by this that it is advisable to excessively wet the pavement. Any pavement material will wear longer if dry than wet. Continual moisture and mud on a pavement, combined with the abrasion of steel wagon tires, produces the condition which is employed to saw and plane stone and other hard substances. The bituminous macadam does not entirely overcome this but by filling the voids with an elastic bituminous cement, which is absolutely unaffected by water, it does reduce the effect to a minimum. Like other forms of pavement, bituminous macadam is in better condition for horse and foot traffic when dry and clean than when wet and dirty. It should, therefore, be frequently cleaned the same as other forms of pavement.

The bituminous macadam surface is so dense and the particles of stone are so firmly held in place by the bituminous cement that, even when made of the hardest trap rock, a section of the pavement when chilled and broken will fracture through the stone. In other words the stone will break before it will cleave from the cement.

It will be noticed that, in the asphalt pavement construction the finest sizes of sand are used in the greatest proportion, while the bituminous macadam composition is the reverse of this.

With the assistance of an able chemist of large experience in the study and practical use of bitumens and bituminous construction, and, by devising considerable entirely new apparatus found necessary, the first nine months of the development of the theory were devoted to diligent laboratory work to determine the best ingredients and the best combination of them to carry out the theory of the proposed construction.

In the spring of 1901 the prospect of success warranted the seven Warren Brothers (all of whom had devoted their business lives and training in the several branches of the bituminous and asphalt paving business) in dropping their other interests and assisting in the development. During the first year we succeeded in getting small contracts aggregating something less than 25,000 square

yards in seven cities of the United States, five of which were within fifty miles of Boston. Laid with inadequate equipment and crude ideas of detail, some of this work, while generally satisfactory, does not fairly represent the possibilities of construction.

The attention atracted by the samples laid in 1901 was far beyond the expectations of anyone, and early this year it was realized that much trouble would be encountered in executing work contemplated, and orders were placed in January for seventeen plants of an entirely improved pattern. The plants were all of a modern type of rotary drums, elevators, elevated screens and bins which would separate the stone into different sizes and scales which would weigh each separate size of stone. The work of getting the plants out of the shop made it impossible to have work well under way until after Aug. 1. It became evident early in the present year that, to cope with the demand, a large increase in capital, equipment and practical working force was essential. The results may be briefly summarized as follows:

1. Work constructed and contracted for during the present year—630,900 square yards in the following thirty-nine cities: Allentown, Pa.; Brookline, Mass.; Cleveland, O.; Duluth, Minn.; Holyoke, Mass.; Lynn, Mass.; Manistee, Mich.; Mt. Clemens, Mich.; Nashville, Tenn.; Portland, Me.; Rome, N. Y.; Boston, Mass.; Bay City, Mich.; Cambridge, Mass.; Everett, Mass.; Harrisburg, Pa.; London, Ont.; Mauch Chunk, Pa.; Norristown, Pa.; Nantucket, Mass.; Newport, Ky.; Pawtucket, R. I.; Brooklyn, O.; Brockton, Mass.; Conshocken, Pa.; Huntington, Ind.; Ironton, O.; Lowell, Mass.; Montpelier. Ind.; Newport News, Va.; Norwich. N. Y.; Port Huron, Mich.; Taunton, Mass.; Tacoma, Wash.; Watertown, N. Y.; Saginaw, Mich.; Worcester, Mass.; Waltham, Mass.; Yonkers, N. Y.

This is equal to over thirty-five miles of street thirty feet wide.

2. Capital employed in the business upwards of $750,000.

3. Twenty complete new portable heating and mixing plants, each having as great a capacity as the most modern railway asphalt plant, and with some important improvements thereon.

4. The organization of five well equipped new companies besides the Warren Brothers Company, devoted exclusively to the introduction of this pavement.

5. The regular employment in charge of different departments of the business of ninety-one men who have had from five to twenty-five years experience in the asphalt paving business.

6. At the present time active construction of this pavement is being carried on in eighteen cities of the United States and Canada.

In one respect the development has been a disappointment to its promoters, and that is in the matter of cost of construction, which proves to be as great as, and in some localities greater than that of asphalt. This does not warrant the taking of more contracts at the prices of some of the earlier contracts taken.

The bituminous cement and stone in the bituminous macadam base cost practically the same as the hydraulic cement and stone in the hydraulic concrete foundation of the asphalt pavement so that the only saving in cost of foundation is the sand and part of the labor employed in mixing concrete. The crushed stone used in the wearing surface generally costs twice and sometimes three times as much as the sand used in asphalt pavement construction.

The bituminous and stone mixture used in the wearing surface of the bituminous macadam is so much more dense and tough than the sand mixture of the asphalt pavement that the time, labor and power required to properly mix the ingredients and handle the mixture on the fully double that of asphalt. This is a condition which we did not foresee.

Like all forms of construction the cost varies very much depending upon the local cost of labor and materials, size of contract and other local conditions.

One important thing which has been developed to a certainty is that bituminous macadam can be laid with special design to provide a rough surface so as to afford a good foothold for horses on very steep grades. In the city of Pawtucket, R. I., the pavement has been in successful use since May, 1901, on a street with a grade of 12 per cent., and has received the unanimous indorsement of hundreds of engineers and practical road builders, who have critically examined it. The Massachusetts Highway Association devoted its quarterly meeting, held in May last, to the examination and consideration of this pavement. I take the liberty of quoting from the remarks of the Hon. W. E. McClintock, chairman of the Massachusetts Highway Assocation, made at that meeting, as follows:

"It has unquestionably solved the problem of pavement for steep grades and, if its cost were double what is asked for it, it would be the most economical pavement for such conditions."

The report of the Associated Road Users of America, heretofore printed in this magazine, was given.

THE USE OF WOOD PAVEMENTS UNDER HEAVY TRAFFIC.

F. A. Kummer, New York City.

I call your attention to a paving block which was removed from Tremont-st., Boston, some months ago, after being in the street nearly two years. It was taken from near the center of the street where the traffic is very heavy, as indeed the traffic is all over this important thoroughfare. The surface of this block is almost as hard as stone and the reduction in depth which is shown is very slight, being at the most not over one-eight inch in two years, or one-sixteenth inch per year, which would give practically an indefinite life to the block. It is further of interest to note that this reduction in depth is not due to wear, but to the compression of the upper fibers of the block under heavy travel, so that it is quite certain no corresponding reduction in depth will be apparent during succeeding years. If you will observe the surface of this block, you will see that under the action of traffic, the sand which was spread over the surface of this street has been driven into the outer fibers of the wood, so that the whole wearing surface is compacted into a tough and absolutely impervious surface, which offers perfect resistance to the action of horses' shoes or the abrasion of rolling traffic.

It is also of great interest to note that the edges of the block have not rounded off any, due to the fact that the blocks are laid as closely together as they can be driven, thereby leaving no point of attack, as is the case with block pavements laid with wide joints. It is the opinion of not only those interested in the block, but of many disinterested observers, that the serviceable life of a properly constructed wood pavement is greater than the serviceable life of granite pavement under heavy traffic, because during the period of five or ten years the corners and edges of granite blocks become so polished and rounded under traffic that not only is the pavement extremely disagreeable to drive over, but is so slippery as to afford almost no foothold for horses, and under conditions of frost, snow or ice, is almost impassable for heaviiy loaded trucks. On the contrary with the wood pavement, even though its surface is smooth, and, when moist, somewhat slippery, as is the case with all smooth pavements, yet the sharp calks of horses' shoes may be readily driven into the vertical fibers of the wood so that slipping does not take place.

As a matter of fact, any unprejudiced observer will readily see by inspection that when dry wood pavements are not as slippery as, for instance, asphalt pavements, owing to the fact that the upper surface of the wood always retains a certain elasticity, which is not found with other forms of pavements. On heavy grades the company with which I am connected has developed a form of pavement which consists of a block laid with a grooved joint, which proves a perfect foothold for horses upon grades, and as so laid in the city of Boston has been absolutely non-slippery, being, in fact, in the words of the former superintendent of streets of that city, "the only permanent, smooth and non-slippery pavement in the city of Boston."

The principal point which I wish to bring out in these few remarks is the question of the use of wood pavement under the heaviest traffic. When I speak of heavy traffic I mean heavily traveled streets in the densely populated parts of our larger cities, such travel even as is found on the streets in London, such as the Strand and Fleet-st.

Granted that it is possible to so prepare wood that it does not absorb moisture and is proof against decay, let us consider how such a block of wood can be destroyed by the action of traffic. If the practice were followed of laying the blocks with one-quarter or one-half inch joints, as is the case abroad, the exposed edges of the blocks would undoubtedly wear with more or less rapidity under the action of the shoes of horses. This wear is not as great in the case of wood as one might at first suppose, as has been demonstrated by the Boylston-st. pavement in Boston, to which reference has already been made; but by laying the blocks on streets which are level or nearly level, with no joints between them whatever, in other words, by driving them so closely together that their surface under travel presently becomes unified, presenting no joints or cracks, a smooth surface results which has no vulnerable point at which it can be attacked by the action of traffic. The calks of horses' shoes cannot chip off the surface of the pavement, as is the case with brick or even stone, nor can the fibers of the wood be ripped off, because they are vertical, and resemble in this respect a bundle of fine wires set on end and tightly wedged together. We have found that the action of traffic on

such a block is to drive the upper ends of the fibers down and compress them, so that the heavier the traffic the more solid becomes the surface of the block, just as would result from the continual pounding with a hammer upon the end of a stick of timber. This felting action, as it perhaps might be termed, upon the fibers of the upper surface of the block is assisted by the resinous material forced into the wood along with the creosote oil, for which reason we have never found a case of brooming in the upper surface of the block as is found with the timber as treated abroad, and especially when laid with an open joint. The whole theory of the vertical fibers in the block is that they should be tightly bound together so that each supports its neighbor, and for this reason the faces of the blocks should not be separated by a joint, if it can be avoided, as otherwise the blocks cannot mutually support each other. In the case of the grooved block used on Boylston-st. the groove between the blocks was one inch deep and the same results would have been secured had the groove been only one-half inch deep. This small groove would leave almost the entire two faces of the block bearing against each other and supporting each other solidly in the street.

Owing to the fact that the wood selected for treatment is all heart wood there is very little difference, if any, in density in the individual block. What difference does exist is largely made up by the greater absorption of the preservative fluid by the more porous block and the corresponding less absorption by the denser blocks. This may, perhaps, seem to you rather a finely drawn theory, but yet the fact remains that over two years of heavy traffic on Tremont-st. has failed to demonstrate the slightest irregularity in the wear of individual blocks. I mention this fact because this is the only way in which such a pavement could wear out; that is, by wearing in spots which would result in holes in the pavement. So long as the wear is even over the entire surface of the pavement, its life is almost indefinite. It is interesting to note that the stretch of wood pavement laid in front of the Auditorium hotel in Chicago, which is now in its fourth year, has shown exactly the same results as those recited above for Tremont-st., and we have been informed by the engineering department of Chicago that the pavement is wearing excellently, and is, in fact, the best piece of smooth pavement in the city.

In the foreign pavements far less care is taken in the selection of the wood and a large majority of the blocks laid have a considerable proportion of sap wood in them. This wood being extremely porous and much softer than the harder blocks, does produce a certain irregularity of wear in the pavement. It is for this reason that the company with which I am connected has thought it necessary to use extreme care in excluding all but the

I. NEW YORK STATE HIGHWAYS.
Concrete Culvert Head-Wall.

best heart timber in constructing its pavements. The four vital points of difference between the London pavements and those laid in Boston are: First, the far greater hardness of Georgia pine as compared with Swedish deal. Second, the treatment of the timber with 22 lbs. of a mixture of creosote and resin, as against 10 lbs. of straight creosote oil generally used abroad. Third, the selection of all heart wood and the exclusion of all sap wood, a practice not followed abroad. Fourth, the laying of the blocks with a tight joint.

It is interesting to note that a recent copy of the Sanitary Record in London stated that the practice of laying wood blocks with a tight joint was rapidly coming into favor in London owing to the greater durability which it gave to the pavement.

In these four respects we believe we have vastly improved upon the foreign practice, yet consider that under a traffic of over 40,000 teams per day the life of wood pavement on the Strand in London is given in official reports as seven years. Very few, if any, granite pavements would be in condition for travel at the end of that time under that traffic. It is therefore first, the splendid showing of the pavements as laid abroad; and, second, the improvements which we now have made over the foreign practice which cause us to say that properly constructed wood pavements have a longer serviceable life than granite.

Ordinances for over $100,000 worth of wood pavements are now under consideration by the City Council of Baltimore, Md., for paving some of the heaviest traveled streets in the city, and the pavement has been recommended for the roadway of the New East river bridge between New York and Brooklyn and for the Blackwell Island bridge between the same points. It is about to be laid on Montague-st. in Brooklyn to replace granite blocks on concrete between the tracks of the Brooklyn Rapid Transit company, and it was recently selected by the Brown & Sharp Manufacturing Company of Providence as the best paving material to be laid in and around its new foundry in a location where constant and heavy trucking makes an extremely durable pavement a necessity.

Anyone who will take the trouble to compare the travel on most of the great thoroughfares in England and continental cities will find that the traffic on these streets is from five to fifteen times as heavy as the traffic on any of the streets in this country. They will also find that most of these great thoroughfares are paved with wood. Is any further argument needed to demonstrate the great durability of wood pavement under the heaviest traffic?

II. NEW YORK STATE HIGHWAYS.
Showing Shoulder and Ditch.

EDITORIAL COMMENT

Discussions of Municipal Problems.

Methods of Highway Construction.

Interurban Railway Franchises in Indianapolis.

Uniformity in Municipal Reports.

Discussions of Municipal Problems. The devotion of this number of MUNICIPAL ENGINEERING to the papers and discussions at the recent convention of the American Society of Municipal Improvements needs no excuse. The field of this magazine includes the entire field of the society. The society has demonstrated the high quality of its membership by the valuable annual reports of proceedings which it has published and by the copious extracts from the papers which have been printed in this magazine in former years. It is the custom of the society to put its committee reports and most of its papers in the form of statements of actual advances made, of new methods tested and proved valuable, of the progress of experiments, so that as a whole the proceedings of the conventions are the most satisfactory reports of the present status and the recent progress in solving municipal problems which can be found. Every reader of the magazine is interested to a considerable extent in municipal affairs and can spend some time profitably in reading the papers presented, and a large proportion of our subscribers will find much of direct practical benefit in them.

There has been quite an epidemic in the formation of societies devoted to one phase or another of municipal improvement. This society was the first one formed and soon decided to devote itself to the practical side of the problems arising. Other associations have been formed by persons interested in special questions or in particular methods of treating them, and seem now to be crystalizing into definite forms, treating from the theoretical standpoint, or from that of the practical politician, the problems of municipal government, from the artistic and æsthetic standpoint the improvement of the city, from the engineering standpoint the problems of water supply, railway, electric and gas lighting and others. The address of President Fisher defines the position of the A. S. M. I., and shows that while its field covers that of some of the societies indicated and overlaps that of others, the phases of problems and the methods of discussion are unique. It is thus a stable center of effort toward municipal betterment, now as in the beginning of its life the solid, practical demonstrator of the applications of theory to practice. As such it is each year extending the appreciation of the value of membership in the organization. This magazine is glad to do its share in making these facts known, and believes it a duty to urge such membership upon its readers.

Methods of Highway Construction. A recent inspection of some New York highways constructed by the state, a study of the specifications under which they are constructed, and a comparison with the methods of construction of highways in Massachusetts, reveals the fact that there are at least two methods of building good roads, and that details almost diametrically opposite in practice may be developed from the same basic principles of construction. The Massachusetts methods of construction were sketched for the American Society of Municipal Improvements at its Rochester convention by W. E. McClintock, the engineer-chairman of the Massachusetts highway commission and a report of his remarks will be found elsewhere in this number of MUNICIPAL ENGINEERING. The principal features of the New York specifications will be touched upon in what follows.

The Massachusetts bids are received for the various materials and operations in detail, so that it is possible to determine exactly the cost of certain methods of construction and the saving by changes in specification. New York contracts being let for a lump sum, estimates only can be made. Massachusetts contracts include all bridges and culverts, while New York bridges of more than 5-feet span are built by the local authorities under separate contract, so that an indefinite amount must be added to the average cost of road per mile in the latter state to make it comparable with that in the former. The first of the accompanying pictures shows the upper

head wall of a culvert consisting of an existing 12-inch pipe and an additional 18-inch pipe. The concrete wall and apron are well shown. In grading, both excavation and embankment, the New York specifications require side ditches of definite form, with shoulders on the grade for the roadway, trimmed up to line, with slope to the ditch which approximates the angle of repose of the material, seldom flatter than 2 to 1. This sometimes makes on a new work a rather deep ditch with quite a short steep slope down to it. The slope and the ditch are both reduced by weather and wear. The difference in customs and habits is shown by the fact that these ditches need not be protected in New York, while in Massachusetts an accident in one of them left unfenced would result in a judgment against the state for damages.

The second of the accompanying pictures shows the general form of the shoulder and ditch, of more than the average depth at the point where the man is standing. Being under construction they are not trimmed to final form. These ditches usually require culverts under the driveways to houses and fields, which must be put in and maintained by the state. Pipe culverts are common for this purpose, but the latest practice is to make them of wood, wide and shallow. Massachusetts constructs the roads and expects the property owners to make their own approaches. The shoulder being omitted the ditch appears to be shallower and ordinarily no culvert or bridge is required under side approaches or driveways.

An important difference between the specifications in the two states is in the sizing of the broken stone or gravel. Massachusetts runs all stone through ½-inch, 1¼-inch and 2½-inch screens. To use the entire product of the quarry, the stones above 2½ inches not again run through the crusher are rolled into the subgrade while it is under process of solidification, the 1¼ to 2½-inch stone is used for the bottom course, that between ½ and 1¼ inches for the wearing surface and the screenings, less than ½ inch for the binder. Mr. McClintock stated that his determination of the sizes for the wearing surface was from actual use on the road and that ½ to 1¼-inch stone had a pronounced advantage over other sizes. The New York specification uses stone from 2 to 3 inches in longest dimension in the bottom course and from 1 to 2 inches in the wearing surface. The wearing surface, bottom stone and screenings may be of different kinds of stone. In order to use the entire product of the quarry used for the bottom layer, the sizes from ½ inch to 2 inches may be used next the subgrade, provided they do not form more than one-third the thickness of the bottom layer. Mr. McClintock reports that he has little trouble with stones projecting above the general surface, while re-covering with fine material seems to be necessary from time to time on the New York roads, thus adding testimony to the correctness of the choice of the ½ to 1¼-inch sizes for the wearing surface. The second, third and fourth photographs show the bottom layer of stone, partly rolled in the second and fourth.

III. NEW YORK STATE HIGHWAYS.
Bottom Course Ready for Rolling.

Another important variance, from the standpoint of cost, is the method of treating the stone in placing. The Massachusetts plan is to compact the stone by rolling until stones will not move under the foot, excepting those actually stepped on, and to use no water until the screenings are put on for the wearing surface. The method of doing this is described in the report of Mr. McClintock's lecture to the A. S. M. I. The screenings are confined to the upper portion of the pavement and the bottom layer is left open and water can readily drain through it to the outlets provided. The New York specification provides that all layers shall be filled full of screenings, other suitable materials, such as sand, being used if the supply of screenings is not sufficient. The first layer of stone is laid and rolled, the finer grades on the bottom as described, and a half inch of the filling material is then spread and rolled and brushed in. If it disappears more is added, and at the last water may be used to help it in if required by the engineer. The fifth picture shows the sprinkling wagon running ahead of the roller on this work. The same process is used until all the layers are completely filled. Apparently the filling of the lower layers is a waste of money. It is not essential that the stone be made waterproof; indeed all but the surface layer would better be porous. It is not necessary to fill the whole thickness to provide for the wearing down of the surface to the bottom, for it will fill under the wear. It is not necessary to hold the stones in place, for they can be and are rolled until they keep their places.

To keep the larger stones from projecting above the surface, the New York road is covered with $\frac{3}{8}$-inch of sand or other material satisfactory to the engineer, thus forming much dust, which blows or washes away, leaving the stone bare and requiring another covering. The sizes used in the Massachusetts road surfaces are said to obviate this necessity and no such covering is used. If of proper quality, the stone put at the bottom of the New York road is very nearly that which would be put on as the wearing surface of a Massachusetts road and with better results as to smoothness.

The cost of the two methods of road building can be compared by reference to the papers by Mr. W. E. McClintock and State Engineer E. A. Bond, elsewhere in this number. We are indebted to F. H. Crafts, C. E., the engineer on the work, for the photographs of the construction under way at the time of making our inspection. An interurban road along a portion of the line, which is not yet put to grade, interferes with drainage, but will be properly taken care of later.

The state of Indiana has no law providing for state aid in building roads, but it has a road law by which counties can construct improved roads, which has been taken advantage of by nearly all the counties. But few counties lack supplies of gravel or of stone which can be used on roads, and thus road building is comparatively inexpensive. Most of the roads are constructed with less elaborate specifications than those described above, but the local circumstances are such that good and fairly durable roads result in nearly every case. A recent report to the Indiana Engineering Society gave returns from 76 of the 92 counties of the state and they have 11,120 miles of gravel road, with an average cost of $1,995 a mile, and 577 miles of macadam road with an average cost of $2,402 a mile. One county has 510 miles of gravel roads, which can truly be classed as good roads, as the writer knows from inspections of part of them. No special attention has been drawn to the matter and the mileage of roads has gradually increased for the past twenty years until now the state probably stands in the front rank in mileage of good hard roads, excellent to travel over for team, automobile or bicycle, fairly well drained and easy to keep in repair, if they were under a common-sense system of regulation.

Interurban Railway Franchises in Indianapolis.

The city of Indianapolis has become one of the most important centers of interurban railway lines, and the development of systems seems to have but just begun. Lines aggregating over 200 miles are now in operation, and new lines, connections and extensions now under construction will shortly increase the length of track directly connected to the city by fully 500 miles. Other lines are under consideration which will undoubtedly place the city at the head in its importance as an interurban railway center.

The mayor and board of public works of the city and the officials of the Indianapolis Street Railway Company have fortunately recognized the importance of the problems involved, and after some months of discussion with the managers of the various interurban railways, have finally reached a

method of operation which will certainly serve as a model for other cities under similar conditions. A short statement of the principal features of the contracts will be of interest.

The interurban lines have heretofore been obliged by the board of public works to enter the city over the tracks of the Indianapolis Street Railway Company. This was deemed burdensome by these companies because a contract with the city company was essential, and they feared extortion. It was not entirely satisfactory to the city company because it would require a number of lines of heavy construction to carry the heavy cars of the interurban lines, and therefore a large amount of reconstruction of existing lines. It has not been satisfactory to the city because the minal company is allowed to lay tracks on certain streets forming an inner belt line, an outer belt line and connecting lines, using existing tracks where they serve the purpose, and must provide a terminal station for passenger traffic. Before the franchise agreement was completed it was announced that contracts with all the interurban companies had been secured by the terminal company. The routes of cars of the various interurban railways are subject to the approval of the board of public works and all must run to the terminal station. The inner loop is to be completed within one year from August 11, 1902, the outer belt within three years, other lines named within three to five years, and the terminal station within eighteen months. Compensation for use of tracks and terminal is subject to

IV. NEW YORK STATE HIGHWAYS.
Bottom Course Partly Rolled.

layout of the present track system has thrown the rapidly increasing traffic of the large cars on streets already congested with the regular city traffic. Terminal stations were found to be necessities, though the interurban lines felt them to be too heavy a financial burden.

The result of the discussion was a terminal company, called the Indianapolis Traction and Terminal Company, formed by officers in and persons friendly to the Indianapolis Street Railway Company. This company has been given a franchise expiring at the same date as that of the Indianapolis Street Railway Company, the terms of the franchise, so far as local traffic is concerned, being practically the same as those of the city company and the two to exchange tickets and transfers. The teragreement or to fixture according to an act of March 3, 1899, and all interurban companies must be admitted and be subjected to the same treatment. The terminal company can not use its lines and cars for freight traffic or other traffic except passengers and United States mail without the consent and approval of the board of public works, excepting supplies for its own use or that of the city. The terminal company is required to pay to the city during the first eleven years of the franchise four cents for each round trip of an interurban car over its lines to and from the terminal under the regulations of the board of public works, six cents during the next ten years and nine cents during the remainder of the franchise period. The terminal company can purchase the city railway system or sell

or lease its lines to the city railway company. The city can purchase the lines under certain conditions. It will be noted that this contract does not touch the question of handling freight and express matter within the city limits.

The form of contract of each interurban railroad company with the city provides the route over which the cars shall run on the lines of the terminal company and methods of changing it, for stoppage to let passengers on or off, for 5-cent fare within city limits, with no discrimination against the city in fare or freight rates, for methods of operating cars, and other similar provisions to those in the city railway company's contract, for character of mail, express and freight matter that may be carried, that freight and express rates shall not exceed those by other common carriers of same classes of matter between the same points, provided they do not fall below 80 per cent. of the present railroad freight rates, and that these provisions do not apply to classes 1, 2, 3 and 4 of freight in 1902.

The subject of method of handling freight is not entirely settled, the provisions additional to those above stated being that when a terminal for handling freight shall have been provided, other freight than that specified in the contract can be carried, and until that time cars may be loaded and unloaded on "dead tracks" of the city company provided cars do not stand more than fifteen minutes. The board of public works reserves the right to regulate the freight and express business and the routes of such cars in reaching the freight terminal.

The subject of freight transfer was thoroughly discussed and left for further regulation when freight stations are provided. It is presumed that one or more such stations will be conveniently located so that cars can reach it over the outer belt line, which is to be constructed within the next three years, and it is probable that knowledge of the freight business and its extent will enable a better system to be established by that time. Meanwhile the character of freight to be carried is such that it can be handled readily on the streets, though there is some complaint of obstruction of traffic, which will doubtless increase as the business increases. Each interurban company must pay to the city one cent for each round trip of a car over the streets of the city. These companies of course ultimately pay the round trip charges against the terminal company for their cars, above provided for, making the total payments to the city 5, 7 and 10 cents per round trip in the three periods above named.

It seems to be the purpose of the city and terminal railway people to consolidate their systems, thus reducing complications of management. The main problems, except that of freight handling, seem to have been well solved, but provisions upon which information is lacking have been left flexible enough for further regulation. The congestion of downtown streets can be relieved by the selection of suitable routes of the interurban cars to the terminal, which must be located within a small designated district convenient to all city car lines and to the business centers.

The city of Cincinnati has a similar terminal company which has erected a six-story terminal station for the use of three interurban railway companies, and is intended for both freight and passenger business. The Indianapolis system gives opportunity for greater development of the freight business without congestion about the passenger terminal and will not restrict the character of freight to be carried so much as the Cincinnati plan. At present interurban lines can carry only package freight which can be left without the care of station agents, except in the larger towns where the amount of business warrants the establishment of an office and agent, so that the Cincinnati station will probably be sufficient for a few years; but future development promises great changes in this class of interurban business, which can be taken care of in the outer freight stations which it is proposed to establish in the Indianapolis system, better than in such a combined station as that of the Cincinnati Interurban Terminal Company.

Uniformity in Municipal Reports.

There has been some progress in the adoption of forms for municipal reports at the various society meetings during the past season. The interest expressed by individual members of the societies has not been great if this is to be judged by the lack of suggestions of improvements of the forms presented by committees. However, much of the disinclination to discuss the forms is doubtless due to the fact that the members consider the determination of the details a matter for experts and doubt their ability to aid in this matter. The societies have expressed their confidence in their committees by adopting their reports, in one case

giving the committee power to change the forms before publishing, if the results of further study during the year seem to require it.

The forms for reports heretofore in use by the New England Water-Works Association were slightly changed at the last meeting of the association, by way of re-arrangement rather than of change in items. The American and Central States Water-Works Associations had adopted the earlier forms at their last meetings, held prior to these changes, but will doubtless follow the New England Association, especially since its changes are improvements and brought the forms close enough to those proposed by the American Society of Municipal Improvements to cause their adoption by that body at its meeting, the report of which appears in this number of MUNICIPAL ENGINEERING. This set of forms has the endorsement of four societies of experts in the field covered by them, and should become more popular than it has been in the past. The New England Association is doing all it can to aid in extending their use and is distributing printed copies of the forms to all interested in them. C. W. Sherman, the editor of the society's journal, 1 Ashburton Place, Boston, Mass., will send copies to all applicants for them.

These forms are restricted almost entirely to the annual reports of operations. The A. S. M. I., believing that uniform reports of cost of construction and uniform summaries of reports for series of years are desirable, has adopted forms for these matters in water-works, paving and sewerage.

It has also adopted forms for the reports of annual operations in paving and sewerage.

This society is the only one which has a direct interest in this class of reports, and these forms are likely to stand as the authoritative forms without further society action. They will be printed in the volume of proceedings of the society for 1902, but arrangements for printing them separately and distributing them will doubtless be made. Geo. W. Tillson, bureau of highways, Brooklyn, N. Y., secretary of the society, and Charles Carroll Brown, C. E., Commercial Club Building, Indianapolis, Ind., the chairman of the committee having the subject in charge, will, meantime, furnish any desired information.

V. NEW YORK STATE HIGHWAYS.
Sprinkler and Roller in Operation.

The committee of the American Gas Light Association has been struggling with the apathy of its membership and has secured an adoption of the forms now completed, subject, however, to modification as the result of further direct communication with the membership, before publication.

Adding these to the Electric Light and the Street Railway Associations' forms for accounts and the Municipal League's forms for financial reports of departments, heretofore described, it will be seen that the municipal activities are nearly all covered. A few subjects are still under consideration by the A. S. M. I., and will be reported upon later.

Important aid in the adoption of these forms can be secured by enlisting the co-operation of the departments of the United States government which collect such statistics. The committee of the A. S. M. I. has been instructed to communicate with the departments interested and consider with them the next steps to be taken.

THE QUESTION DEPARTMENT

COMPARISON OF BITUMINOUS MACADAM, ASPHALT AND FIR BLOCK PAVEMENTS.

Will you send us a statement covering the value of bituminous macadam as compared to asphalt paving, and at the same time give us a short history of bituminous macadam, and whether or not it has given complete satisfaction in cities where it has been laid?

How does bituminous macadam compare with fir blocks on concrete foundation as to cost, wear, etc.?

A. E. Grafton, Daily Ledger, Tacoma, Wash.

A bituminous pavement is one whose cementing material is a bituminous substance which may be made of either asphalt or coal-tar. Asphalt pavements are bituminous pavements; so was the old vulcanite pavement; so is the present tar macadam and the scientific combination of bitumen and stone in bituminous macadam.

Bituminous pavements have been made upon two principles, which have been said to differ just as mortar and concrete differ. Thus the wearing surface of the ordinary asphalt pavement is made up of sand and stone dust with asphalt as a cement. The entire "mortar" takes the wear of traffic, the sand serving to harden the asphalt so that it will stand up to its work. This kind of pavement was developed from observation of pieces of road accidentally improved by having bits of asphalt rock ground into them by traffic, and the mixtures used have been modified as the qualities of materials and the climate have required.

Macadam pavements were originally made of broken stone of different sizes, thoroughly rolled until compacted into a practically impervious mass. Until careful scientific study was made of the results of this rolling no great pains were taken in fixing the proportions of size of stone, and the movement of the stones on themselves and their crushing by the roller finally reduced the voids in the layer by working the stones into their smallest space, and filling the remaining space with the fine dust resulting from the crushing and rubbing of the stones. Tar has been used in occasional macadam pavements for many years to help fill the voids and to hold the stones in place, with greater or less success, according to the quality of the tar used, the sizes of stone and the proportion of tar to voids in the stone.

The term bituminous macadam was first used by Warren Brothers Company. Mr. Fred J. Warren planned his pavement on scientific principles, which have been stated in MUNICIPAL ENGINEERING MAGAZINE. In short, they may be stated as follows:

1. Coal-tar is not all of equal value. The coal-tar made in the old process of making gas had much more of the quality making a durable, weather-resisting cement, than coal-tar made in the water-gas and other new processes of making gas, and tar from which much of the value has been abstracted to make other modern coal-tar products. Thus sidewalks made years ago and the early vulcanite pavements were much more durable than walks and pavements made in the same way but using some of the modern tars. Proper refining and chemical treatment are also necessary to produce the best results, and crude gas-tar should never be used. Mr. Warren, having spent his life in the coal-tar and asphalt trades, had opportunities of study of successful and unsuccessful pavements and of chemical and physical experiment, which convinced him that by the use of the proper quality of coal-tar, properly treated, a durable bituminous cement for pavements and sidewalks can be made.

2. The voids in the stone or mineral aggregate should be the least possible, and the mixture as dense as possible. All bituminous materials are to a greater or less extent subject to oxidizing, evaporation or drying out on exposure, and by reducing

the voids in the stone, and using enough of the bituminous cement to fill the remaining voids, the amount of the cement exposed to atmospheric influences is reduced to a minimum. The stone is the material which must take the wear of traffic, and the office of the bituminous cement is to bind the particles of stone firmly together and fill the voids in the mass of stone with an elastic, adhesive cement which will hold the pieces of stone in place so that the only wear to which they are subjected is that of the wheels and hoofs on the surface of the pavement, and there will be no wear from movement of stones on each other under the compression of traffic. A sufficient amount of the cement should be used to completely cover every piece of stone and completely fill the voids.

3. In order to reduce the volume of voids to a minimum, the sizes of the stones must be graded and there must be the proper proportion of each size. Experiment shows that to a compact mass of stone of a uniform size, say passing a 2-inch screen and refused by a 1½-inch screen, a large amount of finer stone can be added without increasing the volume occupied materially. By experiment it can be determined what proportion of each size of stone, down to the finest screenings, will leave the smallest proportions of voids, and this proportion should be rigidly adhered to. The result of mixing the bituminous cement with this properly proportioned mass of stone is a bituminous concrete which retains its form and position when properly compacted in the roadway and in which the stones take the wear of traffic and are not subjected to any other wear. When compared with the ordinary surfaces of asphalt or vulcanite streets the bituminous macadam is a bituminous concrete, while the other surfaces are bituminous mortar. A comparison with Portland cement concrete and mortar is legitimate, and it may be concluded from this comparison that the bituminous concrete will be stronger than the bituminous mortar. A further advantage is claimed for the bituminous concrete from the fact that a much smaller amount of the bituminous matter is exposed to the action of the elements than is the case with the bituminous mortar of the asphalt or vulcanite pavement, and therefore, the deterioration of the cementing material is reduced to a minimum.

4. The bonding of the surface layer to the foundation must be perfect, that there may be no waving or movement of the one on the other. This can be more thoroughly done with the bituminous macadam.

The claims in the third paragraph are based on many years of successful experience with bituminous materials. The street pavements laid according to the scientific process, some of the steps of which have been referred to above, indicate that these claims are well founded. The partial success of older tar-macadam pavements, laid without due consideration, is an indication in the same direction, but much greater success is confidently predicted for the well designed pavement by those who are most familiar with it. It is hardly necessary to suggest that successful pavements can hardly be expected if they are laid by persons whose commercial interests are in any way antagonistic to the success of the construction.

Users of bituminous macadam report important advantages over asphalt, such as less noise and superior foothold.

The question of cost is so largely a local question that comparisons, unless of actual bids for local work, or by persons conversant with local conditions, are not of very much value. Wide differences in cost of the same class of work in different localities show the necessity of special estimates for each locality. Stone is one of the principal items in the cost of construction, and its cost in some localities is two or three times as much as in others.

Fir blocks, not creosoted, do not make a durable pavement, rot and wear reducing the surface rapidly to a roughness which is very unsatisfactory. In Indianapolis, where nearly all the well laid wooden block pavements in the country are located, creosoted rectangular yellow pine blocks on concrete foundation cost some years as much as asphalt and other years up to 50 per cent. more. In a fir country, untreated timber can be laid at a very much less cost, but its life in good condition is not likely to be more than five years. The troubles from expansion, decay, and excessive wear of soft blocks require constant repair.

That bituminous macadam is satisfactory to the property owners on the streets laid with it is shown by many commendatory letters and articles by them, from Brockton and Cambridge, Mass., Pawtucket, R. I., and other cities, and also by reports of a committee of property owners from Utica, N. Y., a committee of the Associated

Road Users of America and other investigators and inspectors of the pavements and the processes under which they are laid.

The following cities have constructed or have contracted for a large amount of bituminous macadam for early construction, amounting in all to about 600,000 square yards:

Brockton, Worcester, Lowell, Taunton, Holyoke, Nantucket, Lynn, Everett and Cambridge, Mass.; Portland, Me.; Yonkers, Norwich and Rome, N. Y.; Newport News, Va.; Nashville, Tenn.; London, Ont.; Duluth, Minn.; South Brooklyn, Ironton and Cleveland, Ohio; Newport, Ky.; Port Huron, Saginaw, Bay City, Manistee and Mt. Clemens, Mich.; Huntington and Montpelier, Ind.; as well as Tacoma, Wash.

The details of the history of tar macadam and of bituminous macadam can be found in articles and reports printed in MUNICIPAL ENGINEERING MAGAZINE during the past two years, and in the report of the convention of the American Society of Municipal Improvements in this number.

CHEMICAL EXAMINATION OF ROAD MATERIALS.

Can you give me the names of any books, pamphlets or magazine articles which treat of chemical methods as applied to the determination of quality of materials for road making? I believe the chemical examination of such materials (which I take to include natural rocks, gravels, sands, clays and especially cements and asphalts) is a rather new development, and I find much difficulty in getting any literature on the subject. *Oliver Hough, Philadelphia, Pa.*

Chemistry has long been applied to the study of asphalt and cement and to clay and shale for brick making, as well as to sand, gravel and stone intended for use in combination with these materials in making pavements. Several of these books in the French and German languages are listed in the catalogues of engineering literature. Among those published in English are: "The Directory of American Cement Industries and Hand-book for Cement Users" ($5), which contains the standard methods of making chemical analyses of cement; Meade's "Examination of Cement" ($1), Tillson's "Street Pavements and Paving Materials" ($4), which gives the results of chemical analyses of nearly all the materials used in all classes of modern pavements; Byrne's "Highway Construction" ($5), which gives the results of analyses of some road materials, mainly asphalt; Crossley's "Table of Analyses of Clay" ($1); Newberry's "The Constitution of Hydraulic Cements" (25 cents).

The chemistry of asphalts and of asphalt pavements has been very thoroughly treated in previous volumes of MUNICIPAL ENGINEERING, and attention has also been paid to the chemistry of cement, stone, sand and gravel in various articles on asphalt, brick, concrete and other paving materials. The list of such articles is very long, but a few of the more prominent may be mentioned, as follows: "Technical Analysis of Asphaltum," vol. viii, p. 20; "The Testing of Clay Paving Material," viii, 118; "Paving Brick in Ontario," viii, 189; "Kinds of Stone Suitable for Road-Making," viii, 317; "California Asphaltum and Bituminous Rock," ix, 10; "Clays Suitable for Paving Brick," ix, 26; "The Chemical Relations of Asphaltum," x, 310, 381; xi, 5, 67, 217; xii, 78; "The Chemistry of Cement," xi, 27; "Allowable Magnesia in Portland Cement," xi, 144; "Opinions of Manufacturers as to Proper Relation of Constituents of Portland Cement," xi, 223, xii, 89; "Standard Tests and Specifications of Portland Cement," xii, 145; "Chemical Constitution of Residuums and Malthas and Its Relation to Water Action," xiii, 1; "Asphalt Examination," xiii, 6; "The Constitution of Hydraulic Cements," xiv, 335; "Residuum as a Flux for Asphalt," xvi, 353. "Failures in Asphalt Pavements and Their Causes," xviii, 18; "The Value of Chemical Tests of Asphalt Mixtures," xix, 182; "Marls and Clays in Michigan," xx, 349.

The annual reports of the engineer department of the District of Columbia, Washington, D. C., those of the state geologist of Maryland and of the highway commissioners of Massachusetts have some valuable material. The *Journal of the Society of Chemical Industry* also has many papers and committee reports upon the chemistry of the materials under consideration.

ASPHALT SIDEWALKS.

Can you recommend to me a good book dealing with asphalt sidewalks and pavements, but more especially the sidewalks? *Edwin E. Shaw, Sydney, C. B.*

Such books as Tillson's "Street Pavements and Paving Materials" ($4) give information regarding the use of asphalt for pavements, but there is no book on its application to sidewalks aside from the trade publications of the agents for asphalts and asphaltic mastics. More information can be found in MUNICIPAL ENGINEERING than anywhere else. There are articles giving a little information on the materials for asphalt sidewalks in vol. xvii, page 152, and

vol. xviii, page 308. In vol. xxi, page 100, there is a full specification for bituminous concrete sidewalks, prepared by F. J. Warren, all of which but the bituminous cement can be applied to asphalt sidewalks, including the other materials and the methods of laying. If asphalt is to be used it must be softer than that used in pavement mixtures, as sidewalks are not subjected to the rolling of traffic which keeps pavement surfaces welded together, and the traffic is so light that a mixture soft enough not to crack under extremes of cold is sufficiently solid to take the wear, provided the asphalt is of a quality which will not become soft enough to mark under foot or become sticky. Natural asphalt of high percentage pure bitumen, neither hard nor brittle, and not mixed with petroleum residuum or coal-tar, makes the best asphaltic cement for the wearing surface. A very small proportion of a temporary liquefier and dryer enables the composition to be laid and compressed more readily and thoroughly. Experience is necessary to obtain the best results with asphalt in sidewalks as well as in pavements.

The foreign rock asphalts are used in walks and driveways by mixing the asphaltic mastic with an additional proportion of bitumen under the directions furnished by the makers of the material.

LITERATURE ON CONCRETE CONSTRUCTION OF BUILDINGS.

Do you publish a work on concrete construction of buildings? Do you publish a paper called "The Cement Worker?" Will you send me information about anything published on the subject of monolithic construction?

F. A. Pearce, Yazoo, Miss.

The "Directory of American Cement Industries and Handbook for Cement Users" ($5) is the only book containing anything about monolithic concrete construction of buildings of which we have knowledge. So far as we can determine there is now no paper published under the name "The Cement Worker." MUNICIPAL ENGINEERING MAGAZINE has more upon the practical use of cement than any other magazine published. Its subscription price is $2 year. The following is a list of a few of the principal articles on the particular subject mentioned which have recently appeared in this magazine; there are many others on all uses of cement and concrete:

In vol. xxi, "Concrete Construction, Mixtures and Manner of Placing in Forms," pp. 112 and 231; "Concrete for Buildings," illustrated, p. 214; "Cement for Stucco and in Wall Plaster," pp., 231 and 386; "Concrete for Walls, Balustrades and Ornamental Work," p. 329; "Concrete Basement Walls," p. 337; "A Concrete Dwelling," p. 362; in vol. xxii, "Concrete vs. Brick and Stone Masonry for Buildings," p. 20; "Concrete Structures for Railways," p. 96; "Concrete," p. 237; "Cracks in Concrete Wall," p. 304; "Molds for Concrete Wall Construction," p. 337.

METHODS OF MAKING CONCRETE BUILDING BLOCKS.

In a recent issue of a mining journal was an article describing machinery for making artificial stone, claiming that all by products, ground stone, refuse from quarries or mines, etc., when mixed with Portland cement can be made into building stone by means of a machine, which, it is claimed, can be taken to a sand bank and, after mixing the sand with cement, the mixture is made into building blocks, having three times the strength of ordinary building brick. What I desire is to know if there is any cheap formula for mixing sand and cement and placing in molds and pressing into form and shape that will be practical for building purposes. The article calls for Portland cement. Are there not American cements as good as the imported? What make would you recommend for such uses? *Wm. W. Morrison, St. Louis, Mo.*

The use of cement for building construction is developing very rapidly, the reasons for the increased use being mainly less cost, and special adaptability to many conditions. The qualities of materials required, the proportions, and the methods of mixing and placing are fully given in the "Directory of American Cement Industries and Handbook for Cement Users" ($5). There are many articles in MUNICIPAL ENGINEERING upon the subject. Among those of special application in the case are one on "Concrete for Buildings," vol. xxi, p. 214, and one on "Concrete Building Blocks," vol. xxii, p. 13.

In our advertising pages will be found the addresses of several firms using two quite different processes of making artificial stone or building blocks. Reference should be made to the "Business Directory" under the heading "Cement Construction," and to the alphabetical list of advertisers. One of these processes uses Portland cement and sand in proportions varying generally between the limits of one of cement for three to seven of sand, which are mixed thoroughly by hand or machine with a minimum of water, then tamped into the machine mold. The blocks are removed from the machine as soon as formed, on removable base plates, and laid aside to set. The

process is rapid, the materials are cheap and the machine can be set up wherever desired, as it is small and simple. The other process uses molds of sand and a wet mixture of cement, sand and stone particles, with coloring matter. The process is slower, as more time is required for the setting of the cement, but no machine is used. Both blocks can be made with any desired faces, and colored to suit the taste. Both are becoming very popular, and are displacing both stone and brick. Both may be made either solid or hollow, but are usually made hollow, as weight and material are thus saved, and the reduction in strength, due to the reduction of about one-third in volume of stone, leaves a large margin over the brick displaced. A solid block may be made stronger than a solid block of the sandstone and limestone used in building operations, and approaching the strength of granite. With sand as the basis of the block, it has the advantage of being practically fireproof.

Highest grade Portland cement is required for the best results in this class of construction. There are many American brands of Portland cement which are suited to the work and in most parts of the United States their lower price cuts out competition from foreign cements, though there are some districts in which high grade foreign Portland cements are just at this time of lower price than American cements of equal quality. The "Directory of American Cement Industries" contains information upon which a fair judgment of the qualities of the various cements on the market may be based. The final choice between several good brands is often made on the basis of price, which may depend upon freight rates. The table of freight rates in the book will be of much assistance here.

CEMENTS AND CEMENT STRUCTURES NOT AFFECTED BY FROST—TOWNS CONTEMPLATING IMPROVEMENTS.

What brands of cement are adapted to use in sidewalks, curb or walls and are not affected by frost? Can you give me any information about southern towns or cities contemplating improvements? *G. B. Wright, Ashtabula, Ohio.*

Experiments with high grade Portland cements used as mortar indicate that they are not affected by freezing unless they are subjected to alternations of freezing and thawing before the cement has time to set. Mortar which has too much water in it may be disintegrated by the expansion of the excess of water in freezing. In general practice it is probable that there will be failures of walls, curb and sidewalk laid in freezing weather on account of the impossibility of insuring the proper conditions. Thorough protection by sufficient covering to prevent freezing is the safer plan if it is absolutely necessary that the work be done after cold weather has set in. The rule in some cities is that no sidewalks shall be laid after November 1, experience showing that some defects always develop in walks laid in weather which subjects them to freezing before the cement has finally set.

Another important argument against laying walks, walls and curb in cold weather is the subsequent expansion in warm weather. The structure when laid in cold weather is at its minimum length and is bound to expand when warm weather comes, especially if exposed to the direct heat of the summer sun. If it is confined at the ends the expansion either breaks the confining boundaries or bulges and cracks the structure at weak points in its length. This effect can be reduced by making greater allowance for expansion in the joints of the work or making the confining structures flexible enough to permit the movement which must occur.

The most common effect of frost upon such structures is through the heaving of foundations or backing on account of the freezing of water in them. This effect is, of course, independent of the character of the cement, but is often wrongly attributed to it. Thorough drainage of foundation and backing and prevention of the access of water from outside are the methods of protection against this action of frost. It is quite as essential to protect the structure from this action of frost as against direct action upon the cement and other materials in it.

Natural hydraulic and puzzolan or slag cements should not be used in structures exposed to the weather. There are also some brands of Portland cement which are really natural cements of extra quality, and are affected somewhat by the weather. The Portland cements of highest quality and reputation for uniformity can be depended upon to resist the action of the weather if properly treated in the process of laying.

Reference should be made to our department of "Improvement and Contracting News" each month for information regarding contemplated improvements. The news of each month is included in the number following, and our facilities are such that the department contains full and accurate reports of work contemplated, ordered and in progress.

WHO MAKES MOLDS FOR CEMENT PIPE?

I wish to purchase a mold to manufacture a 36-inch culvert pipe from Portland cement and sand. I understand that there is a spring mold used for that purpose, but can not locate the manufacturer. Any information on this matter will be greatly appreciated. *S. Birch, ——, N. D.*

We also have been unable to locate any manufacturer of the kind of mold desired. The question is passed on to our readers with the request that any information on the subject be sent to us.

BEST METHODS OF HANDLING CEMENT.

I wish you would send me a list of books which treat the subject of hydraulic cements in a way which will enable me, a lay reader, to best understand the handling of the same and the conditions necessary to secure the best results.

P. H. Forbes, Topeka, Kan.

"The Directory of American Cement Industries and Handbook for Cement Users" ($5) is the best single book on the practical use of cement. The latest edition contains the material asked for condensed from all that has appeared on the subject up to the date of its publication. MUNICIPAL ENGINEERING ($2 a year) continues to give all the valuable additions to cement literature so far as practical tests and use are concerned, and the development of the cement industry is so rapid that every number must devote some space to the subject.

Other American books are Spalding's "Hydraulic Cement" ($2), Jameson's "Portland Cement" ($1.50), Cumming's "American Cements" ($3). An excellent English book is Redgrave's "Calcareous Cements" ($2.75).

NEW CEMENT MANUFACTURING COMPANIES.

Kindly inform me what cement companies have been formed or are in process of forming, since the publication of the last edition of the "Directory of Cement Industries and Handbook for Cement Users." *L. W. Bosart, Jr., Bond Hill, O.*

The following names of new cement companies have reached this office since the date referred to:

Quaker Portland Cement Co., Jersey City, N. J., incorporated by Clifford W. Lyon of New York and George L. Dayton of Jersey City.

Raven Lake Portland Cement Co., Ltd., Toronto, Can., works to be located at Raven Lake, Ont., incorporated by George McHugh of Victoria, John Lucas, Duncan Robertson and Thomas Christie of Toronto, J. H. Carnegie of Coboconk and W. Sargent of Barrie, Ont.

Federal Cement Co., Camden, N. J., incorporated by William Jay Turner, Morris Faezler and George H. B. Martin.

West German Portland Cement Co., Chelsea, Mich. Linus S. Leach and Howard C. Miller of Detroit.

Oolite Portland Cement Co., of Jefferson county, Ky., incorporated by R. H. Evans of Detroit, Mich., and J. W. Jenner and J. L. Reid of Louisville, Ky.

Lebanon Valley Portland Cement Co., of Augusta, Me., with capital of $600,000.

Lion Portland Cement Co., Allentown, Pa.; works to be located near Nazareth, Pa. Edward Harvey, president; William R. Yeager, treasurer; Aaron Barnes, secretary. Plant of 2,000 barrels daily capacity, proposed to be ready by April, 1903.

Superior Portland Cement Co.; works to be located at Martin's Creek, Pa. W. B. Shaffer, of Nazareth, Pa., promoter.

Allentown Portland Cement Co., of Allentown, Pa., with capital of $130,000.

Waite Stone, Lime and Land Improvement Co., Ltd., incorporated by Fred H. Aldrich, George D. Wandless and W. A. Waite, of Detroit, with capital of $150,000.

Victoria Company, of Detroit, to manufacture cement and other products, at East Tawas, Mich. Charles Montague, Caro, president; E. E. Loud, Ausable, treasurer; Julius Freud, Detroit, E. G. Stevenson, and John F. Wilmot, Detroit, secretary.

Superior Portland Cement Co., Toronto, Ont., to erect works at Orangeville, Ont.

Stewart Iron Co., Ltd., Sharon, Pa., a slag cement plant.

Others concerning which information thus far received is indefinite are the Granite Portland Cement Co., Cleveland, Ohio, to erect works at Meadville, N. Y.; Myrick Bros. Co., Beaumont, Texas; Acme Cement Co., Acme, Texas; West Virginia Lime and Cement Co., Burlington, W. Va., incorporated by H. E. Weaver and others, of Grafton, W. Va.; Apollo Cement and Manufacturing Co., of New Jersey, incorporated by K. J. Hendricks and others, of Pittsburg, Pa.; West Virginia Lime and Cement Co., of Louisville, Ky., to make lime and cement at Kindricks, W. Va.; Century Carbonate Co., of Burlington, N. J.; Moore Cement Manufacturing Co., of Winnipeg, Man., incorporated by Wesley Moore and others, of Miami, Man.; Elite Portland Cement Co., Louisville, Ky.; Silex Portland Cement Co., 1220 Chamber of Commerce, Chicago, Ill.; San Francisco Portland Cement Co., M. I. Wilcox, treasurer; Texas Cement and Plaster Co., of Okla-

homa City, incorporated by S. M. Gloyd and others, of Oklahoma City; Waycott & Sweeney, Colorado Springs, Colo.; Central Cement Co., Coplay, Pa.; Pittsburg Portland Cement Co., incorporated at Dover, Del.

Other projects are under consideration at or near Ludlow, Ky.; Coboconk, Ont.; Dillon, Kan.; Amherst, Wis.; Schoolcraft, Mich.; Cartersville, Ga.; Blairstown and Arlington, N. J.; Evansville, Pa.; Bay City, Mich.; Catskill, N. Y.; Cowansburg, Pa.; Johnsonburg, N. J.; Colon, Mich.; Wharton, Ont.; Keese, Wash.; Epes, Ala.; Riverside, W. Va.; Whatcom, Wash.; Savanna, Ill.; Cumberland, Md.

MAKERS OF CEMENT TESTING MATERIALS.

Could you inform me as to where I could get cement testing materials, such as Stubbs' wire gauge sieves, briquet molds, etc.? *W. E. Stevens, Beloit, Wis.*

The makers of testing machines listed under that heading on page 719 of the "Directory of American Cement Industries and Handbook for Cement Users" ($5) can furnish the materials desired.

MACHINERY FOR CEMENT MANUFACTURE—ENGINEERS DESIGNING CEMENT PLANTS.

I want a book or books that will give me all the details of manufacture of cements and detailed descriptions of the best machinery used in the larger modern works. I would like to correspond with some makers of cement machinery who can give me a list and specifications of what is needed. I would be pleased also if you can refer me to some reliable engineers who have constructed cement works and can furnish plans and specifications for a plant. *J. R. H., Charleston, S. C.*

"The Directory of American Cement Industries and Handbook for Cement Users" ($5) gives general descriptions of the processes and machinery in use in all classes of cement works in this country. Considerable detail of the modern processes will be found on pages 18–22, 262, 265, 271, 282, 291, 298, 301, 312. Some more space is given to the descriptions of about a dozen American plants in "The American Cement Industry" ($3), but the details of machinery are not fully given. "The Rotary Kiln" ($2) illustrates plants in which this and other modern cement apparatus have been installed and gives the principles upon which it operates. The text-books on cement are, none of them, of recent enough date to contain full and accurate descriptions of the rotary kiln methods and machinery. One such book is reviewed in another department of this number.

The lists of makers of and dealers in machinery and supplies for cement plants beginning on page 678 of the "Directory" should be referred to for the cement machinery manufacturers desired. See in particular the lists under the headings of "Ball Mills," "Cement Machinery," "Dryers," "Grinding Machinery," "Kilns," "Tube Mills," etc. For names of engineers designing cement plants refer to the list under the heading "Cement Tests and Analyses" beginning on page 675 of the "Directory."

For names of reliable manufacturers of cement machinery and of competent engineers designing cement plants, reference may also be made to the business directory in our advertising pages under the headings "Cement Machinery," "Cement Packers," "Cement Pans," "Chemical Tests," "Clay Working Machinery," "Conveyors," "Crushers," "Dryers," "Screening Machinery," "Testing Laboratories," "Cement Plant Designers."

BOOKS ON SEWERAGE AND SEWAGE DISPOSAL, PLUMBING AND PURIFICATION OF WATER.

Please suggest some practical and up-to-date manuals on sewage disposal, sewerage engineering, purification of water, and the principles and practice of plumbing suitable for an inspector of plumbing. Please state where I can find reviews of the books you refer to. *John Gadsden, Jr., C. E., Charleston, S. C.*

On sewage disposal Rideal's "Sewage and the Bacterial Purification of Sewage" ($3.50) is a valuable English book. A review of it will be found on page 294 of MUNICIPAL ENGINEERING for October, 1902. Rafter and Baker's "Sewage Disposal in the United States" ($6) gives a view of the field at the date of its publication. Other less extended discussions of the subject are Kiersted's "Sewage Disposal" ($1.25), Barwise's "Purification of Sewage" ($2), and Robinson's "Sewerage and Sewage Disposal" ($4.50).

On sewerage engineering, in addition to the above may be named as important contributions to the literature on the subject, Folwell's "Sewerage" ($3), Staley and Pierson's "The Separate System of Sewerage" ($3), and Moore's "Sanitary Engineering." Reviews of the first will be found in vol. xix, pages 90 and 365, of the second in vol. xix, page 90, and of the third in vol. xxiii, page 52. The first reviews mentioned are in an article comparing three books on sewerage.

On purification of water the principal books are: Hazen's "Filtration of Public Water Supplies" ($3), Fuertes's "Water Filtration Works" ($3.50), Hill's "Purification

of Public Water Supplies" ($3), Rideal's "Water and its Purification" ($2), and chapters in such books as Turneaure's "Public Water Supplies" ($5). Most of these books are described in an article comparing them with each other and with several other books on water supply to be found in vol. xxi, p. 6. Reviews will also be found in vol. xv, p. 388, of Hill's book, and vol. xxiii, p. 295, of Rideal's book.

Standard books on house drainage are: Coleman's "Sanitary House Drainage" (English), Waring's "How to Drain a House" ($1.25), Gerhard's "House Drainage and Sanitary Plumbing" (50 cents). A new book giving New York City practice is Price's "Handbook on Sanitation," ($1.50), a review of which will be found in vol. xxii, p. 183.

SEPTIC TANK TREATMENT OF SEWAGE.

I have been reading with great interest the many articles appearing in MUNICIPAL ENGINEERING on sewage disposal during the past year and am very favorably impressed with the septic tank and filter processes described therein. I have seen no statement as yet as to how the sewage is treated in the septic tank. Could you inform me what chemicals are used, how often applied, and in what quantity for a given capacity of tank, and the probable cost of the same? Are the septic tank and the method of treatment covered by patent?

Chris. Stichnath, Town Engineer, Hyde Park, Ohio.

The use of chemicals in the treatment of sewage was developed upon the principle of arresting as completely as possible the fermentation and decay of the organic matter, at least until it could be removed from the water and put in form for complete change to inorganic forms. The principle upon which the septic tank treatment is based is the encouragement of fermentation and decay and the cultivation of the bacteria which perform the work of changing the organic matter into innocuous inorganic compounds which are beyond the fermenting stage. Chemicals which will interfere with the development of these bacteria are therefore very objectionable, and, in fact, no chemicals are used in any stage of the process.

A study of the articles referred to will show that the bacteria which can work and do work best without oxygen are those which develop in the septic tank, for the oxygen in the sewage is quickly consumed and the thick scum which forms on the surface prevents the access of any more. The quiet and very slow flow of the sewage through the tank is favorable to the action of the bacteria and the effluent is greatly cleared of the fermentable organic matter in the raw sewage. A second class of bacteria need oxygen for their operations and a complete purification of the sewage requires its subjection to a stage which is favorable to their action. This stage is furnished in the contact beds or sewage filters, and unless the provisions for full supply of oxygen are complete the effluent from the filters will not be satisfactory.

The effects of acidity and of alkalinity of the sewage in the various stages are not yet fully studied, and the possibility of aiding the bacterial action by the use of chemicals in small quantities to modify the sewage to suit the bacteria whose action is desired has not yet been considered very seriously. In the meantime no chemicals are used, and the only modifications in treatment of different kinds of sewage are mechanical, or in the filling materials of the filter beds.

The Glover patents, the claims of which have been stated in MUNICIPAL ENGINEERING several times in the past two or three years, are said to cover the septic tank and filtration process as a whole, but a number of plants have been constructed without reference to these claims. The owners of these patents have brought suit against the village of Liberty, N. Y., for infringement of their patent by the sewage disposal plant now in operation there. A description of the plant, with illustrations, will be found in MUNICIPAL ENGINEERING, vol. xxi, p. 1. It is understood that a similar suit has been begun against Plainfield, N. J. It is desired by all engineers that these suits be carried through and decided as soon as possible, whether the patents are declared to cover such plants or not. Patents on special apparatus for operating such sewage disposal plants are held by several parties. They are numerous in England, and some of them are being introduced in this country. One such system, that of the Cameron Septic Tank Company of Chicago, is described in vol. xxii, p. 1, where the sewage disposal plant at Glencoe, Ill., is illustrated, and in vol. xxiii, p. 192, where a small plant at Clayton, Mo., is shown.

BOOKS ON GOLD MINING.

I would like to have the latest thing published on gold mining, giving in detail the latest methods and least cost. *J. H. Ragsdale, Pulaski, Tenn.*

The methods of gold mining vary greatly as the method of occurrence of the gold varies. Curle's "The Gold Mines of the World" ($3.50), is said to contain descrip-

tions of and data concerning gold mines and mining in all parts of the world, and should give a good idea of the methods followed in mining the various ores and recovering gold. Books on special methods of mining gold are Randall's "The Quartz Operator's Handbook" ($2), Van Wagenen's "Manual of Hydraulic Mining" ($1), Bowie's "Hydraulic Mining in California" ($5), Wilson's "Hydraulic and Placer Mining" ($2), Ihlseng's "Manual of Mining" ($4).

COST OF WATER-WORKS PLANT.

Our city needs water-works and some of the citizens propose to construct a plant to be transferred to the city at cost when certain conditions have been fulfilled so that the city can acquire the works without passing the constitutional limit of its indebtedness. We need a general estimate of the probable cost of such a system as a basis for forming the company and making an agreement with the city, details to be worked out by an engineer when the capital is secured. It is entirely an enterprise for the benefit of the public without profit to those carrying it out. We will need two 8-inch driven wells, a 90-foot standpipe or tank, one mile of 8-inch mains, one mile of 6-inch and two miles of 4-inch, with 50 hydrants. Two 750,000 gallon pumps are proposed, and two 80-horse-power boilers. Can you give us a general idea of the cost of construction and the probable cost of operating?

J. W. R., ——, Ind.

There are several variable quantities in a system of this sort, and the choice made will largely influence the cost of the system. The depth of the wells, whether a standpipe or an elevated tank is used, the kind of pumps and boilers and the material and design of the pumping station will all affect the total cost. It may be roughly stated as lying between $30,000 and $40,000. Under some circumstances the cost may be less than the lower figure, but under present conditions in the markets for material and labor it is probable that the cost will be above that figure, though not as much as the larger sum if the most economical design is made. The cost of operation will depend upon the choice of machinery and fuel. The engine of less first cost usually costs the most for operation. The average daily pumpage is an important factor, also the arrangement which can be made for attendance of boilers and pumps. The cost can easily vary from $500 to $1,500 a year. The engineer who designs the plant can probably determine most of the conditions and make a fairly close estimate in advance of the annual expense. Interest, repairs and depreciation, as well as ordinary extensions of services, must be taken into account in computing the expenses and determining whether the venture will pay its way. On the other hand, the probabilities of increase in revenue from new consumers must be weighed.

BOOK ON ELECTRIC ARC LAMPS.

Have you any small book on the repair and management of arc lamps?

W. B. Pringle, Newnan, Ga.

Exactly the book desired does not seem to be on the market. Foster's "Electrical Engineer's Pocket Book" ($5) is not a small book, but has eight or ten pages on the installation and management of arc lamps in its thousand pages of material for the use of the electrical engineer. The second volume of Crocker's "Electric Lighting" ($3) is devoted to the distributing system and lamps, and is probably the best treatise on this subject. Other books, having more or less available material, are Fleming's "Electric Lamps and Electric Lighting" ($3), an English book; Houston & Kennelly's "Electric Arc Lighting" ($1), Levy's "Electric Light Primer" (50 cents) and Preece's "Electric Lamps."

PACKING FOR CONDENSER TUBES.

I understand that there is a patent condenser tube packing on the market that takes the place of the old-fashioned corset lacing. Please give me particulars of same.

Frank Smith, Danville, Ill.

The packing to which you refer is manufactured by the inventor, Mr. Joseph Allen, Collingswood, N. J. This packing is made of best American cotton, is woven in a special manner, comes in the form of a sleeve, and lubricated or treated with a compound that enables it to be slipped over a tapered tool. The inventor claims that one man can easily and comfortably pack from 1,500 to 2,000 tubes in a day, while the packings last as long as the tubes. They are in use by leading condenser builders and shipbuilders of the United States and other countries.

MAKERS OF GAS PLANTS—CLAY ANALYSTS—FIRE-BRICK MANUFACTURE AND TESTING.

1. Will you kindly give me names of concerns, particularly in the middle west, who manufacture and install gas plants?

2. I would also like the names of men who could and would analyze samples of clay with a view to ascertaining its value for fire-brick purposes.

3. Can you direct me to any literature upon the subject of fire-brick manufacture or articles describing methods of testing fire-brick.

A. L. Goodwillie, Chicago, Ill.

1. The following are makers of gas plants who are located in the district named: Kerr-Murray Mfg. Co., Wayne Engineering

and Construction Co., and Western Gas Construction Co., at Ft. Wayne, Ind.; The Stacey Mfg. Co., Cincinnati, Ohio; Fred Bredel, Milwaukee, Wis.; Lloyd Construction Co., Detroit, Mich.

2. Names of chemists who can analyze fire-clays will be found in the business directory in our advertising pages under the heading "Chemical Tests."

3. There are no books known to the writer treating exclusively of fire-brick. Material of value will doubtless be found in Davis's "Practical Treatise on the Manufacture of Bricks" (85). An article on the manufacture of fire-brick at Mt. Savage, Md., which appeared in *Engineering News*, April 10, 1886, gives some detail of the operations and apparatus. An article giving methods of determining the refractoriness of fire-clay appeared in the *Technical Quarterly*, December, 1893, and one on methods of determining the fusibility of fire-clays in the transactions of the American Institute of Mining Engineers for 1893.

MUNICIPAL MATTERS IN COURT

Abstracts from Decisions of the Higher Courts—New York City Owns All Its Water Front—New Orleans Sewer and Water Board a Legal Body.

Abstracts from Decisions of the Higher Courts.

Prepared by Andrews & Murdoch.

Bicycle Path—A city not under any duty to construct a bicycle path, which exercises its option to do so, is bound to maintain the path in a condition reasonably safe for the purpose for which it is intended. Where there is a sharp turn in a bicycle path maintained by a city at a point about four feet from a gutter and sidewalk, with no barrier or light at the turn, the city is liable to one injured, owing to such condition, while using ordinary care. Prather vs. City of Spokane, 70 Pac. Rep. (Wash.) 55.

Billboards Prohibited—Under a charter authorizing a city to enact such ordinances as should be deemed expedient for the good government of the city and the promotion of peace and good order, a city has power to enact an ordinance prohibiting the erection of bill boards of more than a specified size. Gunning System vs. Buffalo et al., 77 N. Y. Supp. 987.

Contention Over Building City Hall—Where a resolution of a city council was for the building of a city hall, and intention to build in accordance with the resolution was shown, a contention in a suit to restrain the building that it was intended to build an opera house was of no merit. Parker et al. vs. City of Concord et al., 52 At. Rep. (N. H.) 1095.

Defective Sidewalk—Duty of Council.—Where a village council is informed of the defective condition of a sidewalk, it is its duty to put it in a condition reasonably safe and fit for travel, and this duty is not discharged by merely sending a man to repair it, but it is a question for the jury to determine whether the repairs made by him were such as to render the walk reasonably safe. Styles vs. Village of Decatur, 91 N. W. Rep. (Mich.) 622.

Erection of Barriers Around Defect in Street.—A municipal corporation is under no duty to erect barriers or to maintain lights to prevent injury to persons seeking to enter a street from private land at a point at which there is no traveled way either public or private, and at which there is nothing to put the municipality on notice that an entrance is likely to be attempted. Iveter vs. City of Atlanta, 42 S. E. Rep. (Ga.) 220.

Fire Plug Concealed by Vegetation.—Where a fire plug, though lawful and necessary in the place it occupied in the public street, was concealed from view by vegetation, and was so close to the beaten roadway that a vehicle passing at that point could be avoided only by turning toward it, the city with knowledge of the conditions, which rendered it dangerous to travelers, was guilty of negligence. Thunborg vs. City of Pueblo, 70 Pac. Rep. (Colo.) 148.

Liability of Citizens for Negligence of City.—The inhabitants of a city, who call upon it to construct and care for a local improvement, such as a sewer, a water main, a street, which it has the legal authority to construct and to con-

trol, and who use the improvement after its completion for the purpose and in the way prescribed by law, are not liable jointly with the city for the damages which result to third parties for the negligence of the city in the construction, management or operation of the betterment. Carmichael et al. vs. City of Texarkana, Ark., et al., 116 Fed. Rep. 845.

Location of Pest House.—As Ky. St., section 3,909, expressly forbids the location of a pest house for the treatment of eruptive or contagious diseases within the corporate limits of any incorporated city, and provides a penalty against the "officer" or "person" who shall violate the section, the council cannot bind the city, even by an ordinance providing for the erection of a pest house within the city limits, as such an ordinance would be ultra vires, and therefore a city of the fifth class is not liable for injury to property from the erection of a pest house within the city limits, whether there was or was not an ordinance providing therefor. Arnold vs. City of Stanford, 69 S. W. Rep. (Ky.) 726.

Sewerage Contract—Payment.—Laws 1891, c, 124, section 153 (City Charter of Superior), provides that sewer contracts may, at the option of the city, require the contractor to receive interest-bearing certificates as payment for so much of the work has been assessed against the lots benefited, the residue to be paid out of the general sewer tax. Section 154 provides for a sewer assessment against lots benefited at a rate of $2.50 per lineal foot, and section 156 provides for paying the cost of sewers in excess of $2.50 per foot. Section 157 authorizes the council to levy a certain tax and to issue bonds "in case anything additional is required." Section 158 provides that the contractor may receive certificates in payment "as far as the same will go," and shall be entitled to receive city orders for the balance. A sewerage contract provided that the contractor should receive assessment certificates in full for all claims against the city, and the price of the sewer did not exceed $2.50 per foot. The certificates received provided that the holder should have no claim against the city, except for the special assessments for the work. Held, that the general provisions of the charter (sections 147-174) empowering the city to "construct systems of sewerage" and to "issue improvement bonds for sewerage assessments" did not render the city a guarantor of the collection of the certificates, but that under the charter, contract, and certificates the holder thereof was without remedy against the city in case of failure to collect. Roter vs. City of Superior, 91 N. W. Rep. (Wis.) 651.

Sidewalk Repairs—A city is liable for personal injuries resulting from its negligent failure to see that a sidewalk is kept in repair, though the dangerous condition was created by the abutting lot-owner, and he is jointly liable. City of Covington vs. Johnson, 69 S. W. Rep. (Ky.), 703.

Street Improvements; Objection by Owners—Sec. 3 of the street improvement act provides that where not more than two blocks remain unimproved between improved portions of a street, etc., the work on the intervening part shall not be prevented by any objection, unless the council shall deem proper. Held, that the effect of the statute is that the objection, if allowed, will have the effect not only to stay the work, but to divest the board of jurisdiction to proceed further without a new resolution of intention. Pacific Paving Company vs. Sullivan Estate Company, 70 Pac. Rep. (Cal.), 86.

New York City Owns All Its Water Front.

In two decisions filed by the New York supreme court Oct. 29 it held that the city held exclusive ownership in the streets, piers and bulkheads along the water front, notwithstanding private grants to corporations and individuals. The case of the Knickerbocker Ice Company, which applied for an injunction to prevent the city and the Grand-st. Ferry Company from constructing a bulkhead across the railway company's water lots in the Hudson river, was the more important of the two decisions. The ice company claimed exclusive ownership in the water lots and adjacent streets and lands. Justice Steckler holds that the Dongan charter of 1686 granted to the city all lands between high and low water marks around Manhattan Island.

New Orleans Sewer and Water Board a Legal Body.

In an opinion passed upon the merger act Oct. 6 Judge W. B. Sommerville of the civil district court at New Orleans maintained its constitutionality, and held that the legislature had power to pass the measure constituting the new sewerage and water board, and that its newly-constituted membership does not violate the law's provision in any way. An appeal will be taken.

STREETS AND BRIDGES.

Some Concrete Construction in Grand Rapids, Mich.—Warren's Bituminous Macadam Pavement at Huntington, Ind.—New Track Elevation Ordinances.

Some Concrete Constructions In Grand Rapids, Mich.

By courtesy of City Engineer L. W. Anderson we present to our readers some photographs of recent concrete constructions in Grand Rapids, Mich. Three of the pictures give views of the concrete steel arch over the East Side power canal at Bridge-st., under construction and completed. The arch has a thickness of 1½ feet at the crown and 4½ feet at the springing. The steel bars are ¾-inch by 3 inches and two of them are bedded in the concrete every three feet. Concrete walks are included in the contract and thirty conduits are laid under each walk for underground wires. The contract price of the bridge, complete, is $30,286. Inspection, advertising and incidentals add $615.36 to the cost.

One of the pictures shows the Portland cement concrete street pavement on Briggs-court. It consists of two 3½-foot walks and a 23-foot roadway with 4-inch crown and 5-inch curb exposure. Donald-st. has a similar pavement with 4-foot walks and 18-foot roadway. The base of the pavement is made of one part Portland cement, three parts sand and five parts screened gravel, between ¼ and 1-inch in size. The top is one part cement to two parts sand. It was laid in alternate 6-foot sections with a ½-inch expansion joint at the curb and a template made joint at the crown. Coarse brush finish was given the surface. Pavement has 6-inch base and 1-inch top. Sidewalks have 3½-inch base and ¾-inch top. Briggs-court has 914 square yards of roadway and the contract price was $1,631; $1.78 a square yard, nearly 20 cents a square foot. Donald-st. costs $2,000 for 1,282 square yards, or $1.56 a square yard.

The pavements are not yet old enough to show their durability, but it is reported that the joints have a tendency to break down under traffic.

Warrens's Bituminous Macadam Pavement at Huntington, Ind.

The Hoosier Construction Company of Indianapolis has completed the paving of Wilkerson and Matilda-sts. with Warrens's bituminous macadam waterproof pavement. This is the first of these modern pavements completed in Indiana. Our illustrations show the work in progress and as completed.

The pavement is made by laying a base or foundation of bituminous concrete which is rolled in place with a fifteen-ton roller. The wearing surface, two inches in thickness after being finished, is composed of hard, broken stone in sizes ranging from one and one-half inches in diameter to a fine powder, so graded or assorted that the small stones fill the interstices in the larger ones, and the still smaller stones fill the spaces between the next larger size, and so on down to the finest powder. These stones are then heated and mixed with a specially prepared bituminous cement, and spread on the foundation the same way that asphalt is laid, and rolled to a true surface with a fifteen-ton roller. A coating of liquid bituminous cement is squeezed over the surface and fine stone chips sprinkled thereon and rolled into the surface with a heavy roller, thus giving a fine foothold for horses.

The pavement is smooth and very quiet, and some of the best engineers say that it will last until the stone is worn out.

The people of Huntington are much pleased with the pavement. All of the property-owners on the streets named, the mayor, engineer and many merchants and business men have united in signing a high testimonial of its merits to the company that laid it.

Many delegations of officials and property-owners from other cities have been to Huntington to see it, and, judging from their reports, all have been much pleased with the bituminous macadam pavement.

The cost of the pavement was less than asphalt, and about the same price as brick well constructed. The company is engaged in constructing the same class of pavement in other cities. Large areas of the pavement are being laid all over the United States this year and excellent reports come from every city in which it has been laid.

New Track Elevation Ordinances.

Track elevation is provided for in an ordinance introduced in the town council of Harrison, N. J., Oct. 7. The ordinance passed first and second reading and was then laid over for the required 20 days before final passage. An ordinance has also been prepared by Chas. J. Poetsch, city engineer at Milwaukee, Wis., providing for the elevation of all railroads on the south side. The ordinance specifies the hight, the subways to be left for streets and the technical points to be observed in the construction work.

MATILDA STREET, HUNTINGTON, IND.
Laying Wearing Surface of Warren's Bituminous Macadam Pavement.

SCREENINGS ROLLED INTO WARREN'S BITUMINOUS MACADAM PAVEMENT WITH HEAVY ROLLER.
Huntington, Ind.

WILKERSON STREET, HUNTINGTON, IND.
Completed Warren's Bituminous Macadam Pavement.

SOME MUNICIPAL PROBLEMS

Provisions of Ohio's New Municipal Code—The New Jersey "Oranges" Propose to Consolidate—Nashville Wants a Municipal Telegraph System—Terms of Compromise of Nashville Street Railway Litigation—Water Service Put in Below Cost in Tacoma.

Provisions of Ohio's New Municipal Code.

The Ohio legislature, which met in special session Aug. 25 to enact a code of uniform laws for the government of municipalities, accepted the report of the conference committee and adjourned Oct. 22. Under the provision of this code, which goes into effect Nov. 15, 1902, all cities are to have boards of public service and safety. The boards of public service are to consist of not less than five members, and the boards of safety of not less than two and not more than four members.

The present city council will determine in each instance the number of board directors. The safety board number cannot be changed in less than four years, and the service board number can be changed in two years.

The mayor is at the head of the police and fire departments. The board of safety has the business end of both departments and makes all contracts. The chief of police and fire chief must be members of their departments before being appointed. The merit system will prevail in both departments.

Every city will have a board of health, consisting of five members, appointed by the mayor, who also appoints a library board of six members.

The present city councils must redistrict the cities into wards before Jan. 1. Cities of 5,000 inhabitants will have a council of seven members—three at large and four by wards. The mayor may change items, but not totals. The council may change both, and the mayor may veto the council's acts.

The city auditor must submit a statement of balance to the mayor once a month. The sinking fund trustees act as a tax commission and pass upon the council's estimates.

The mayor may file charges against and remove city officers. The governor may file charges and remove mayors.

The New Jersey "Oranges" Propose to Consolidate.

The platform adopted recently at the Republican City Convention, at Orange, N. J., provides for the consolidation of all the Oranges. The platform declares that civic pride would be stimulated, taxes reduced, municipal expense lessened, and a higher school education, better streets and a general improvement in the governmental methods of all the cities and towns interested, secured.

Nashville Wants a Municipal Telephone System.

According to its mayor, Mr. John Head, Nashville may install a city telephone system. At present the city has one company which claims an unlimited franchise from the city and pays $1 for each telephone inside the corporate lines as a privilege tax, in lieu of all other taxation. The city pays each year for telephone service a greater amount than it receives in taxes, so that taxpayers are practically paying a bonus for the privilege of leaving a telephone system in the city.

Some time since an effort was made to secure an independent telephone system and the council was on the point of granting a franchise when a third company appeared upon the scene, offering to render the service at one-third less than the first independent company had offered.

Some members of the council, however, fancied that they could distinguish traces of the original company's fine Italian hand in this third company, and refused to vote either franchise asked for. Under his own name Mayor Head states that he will ask the legislature when it meets next January for authority for the city to build, own and operate a subway or conduit system large enough to accommodate all overhead wires to the business portion of the city, and also install a telephone system, to be owned and operated by the city.

Terms of Compromise of Nashville Street Railway Litigation.

An agreement has been reached in the litigation between the street railway company and the city of Nashville, which has been pending in the Tennessee courts for more than three years. The trouble was inaugurated by an attempt, more than three years ago, to have the charter of the street railway company forfeited after the initial steps had been taken to have all of the lines of Nashville con-

solidated under one management. Previous to this, however, suit had been filed by the city to recover the cost of paving between the tracks and for two feet on the outside, although the council had, by special ordinance, released the company from this obligation for a number of years. The main issue, however, was the effort to deprive the company of its franchise. The suits against the company were all consolidated and heard by Chancellor Cook. The only point won by the city was on the question of the company paving between the tracks. Chancellor Cook referred the matter to the clerk and master to ascertain the cost of paving the railway company's part of the streets for the years it was released from this duty. Upon being appealed, the court of chancery appeals practically sustained Judge Cook on all lines except to declare that the ordinance under which the consolidation was attempted was void, but it did not work a forfeiture of the rights of the company to use the streets of Nashville. This decision left the company in the same position it was before the consolidation, with the exception that it was not exempt from paving its part of the thoroughfares traversed by its cars. The effect of the litigation was to throw the company into bankruptcy before the case in the state courts had been finally adjudicated. The receivers, Messrs. Warner and Lewis, pursued such a progressive course that the system rapidly sprang into favor. The litigation hampered them, however, and as long as it existed no great amount of improvement could be made. The compromise, therefore, is a fulfillment of the business course pursued by the receivers from the beginning. In consideration of the withdrawal of all litigation against the company the receivers make valuable concessions, as follows: To present the city with Centennial park, which is valued at $125,000; the park commission is to receive annually 2 per cent. of the gross earnings of the company for the maintenance of parks until the earnings reach $1,000,000, and 3 per cent. thereafter, the sum being paid in lieu of privilege taxes; the city will have the right to purchase the property after twenty years; the company will continue to carry out its contract to pave the streets between its rails and for two feet outside of the rails; the company will continue its transfer station; the company agrees to expend the sum of $1,000,000 on improvements, including those already made under the receivership, together with the amount to be expended on the electric light plant.

Water Service Put in Below Cost in Tacoma.

Residents of Tacoma, Wash., have been remonstrating against the charge made by the city for putting in water service. The charge is at present $8 for unpaved streets and $15 on paved streets. With a view to securing a basis of consideration of these numerous complaints a special report has been compiled showing that the city is making water main connections at less than actual cost, the figures being $8.25 and $30 for unpaved and paved streets respectively. An ordinance will be introduced in the council embodying an increase in service rates rather than the hoped for reduction. Meanwhile the remonstrators are sorry that they spoke.

ORGANIZATIONS AND INDIVIDUALS

Mayor With Business Methods—Technical Meetings.—Personal Notes.

Mayor with Business Methods.

The term "captains of industry" became prominent at the time of Prince Henry's visit to this country. The phrase is a happy one and seems peculiarly applicable to a great number of men at the head of the manufacturing and industrial concerns of this country. Surely the men who direct the forces of labor and have brought the country to the front in the commercial world are as deserving of some title of distinction as those who have made their mark in time of war. Mishawaka, Ind., possesses one of these "peace captains" in the person of M. W. Mix, president and general manager of the Dodge Manufacturing Company and mayor of the city. It was during the New Orleans exposition that Mr. Mix

entered the employ of the Dodge Manufacturing Company, being in charge of a small exhibit there. In one capacity or another he remained with the company until 1896, when, on the death of the founder of the company, Mr. W. H. Dodge, he succeeded to the presidency. This was, indeed, a distinguished honor for a young man of thirty years; but Mr. Mix has proved by his works that the judgment of his employer was good. Under his direction the business of the company has increased many times over, and extensive additions have been made to the plant. All kinds of power transmission machinery are manufactured by

MAYOR M. W. MIX,
Mishawaka, Ind.

the plant, a recent achievement of some interest being the casting of a gigantic forty-ton fly wheel.

It is not remarkable that in choosing a candidate for mayor a man of Mr. Mix's ability should be selected, and this is what happened last spring during his absence from the city. Though somewhat reluctant to run for this office on account of his important business interests, Mr. Mix accepted and was elected, taking office the first of September. Up to this time business methods had not prevailed to any great extent in the city government. One instance of the loose methods under which the city's business was conducted is shown in the fact that in rendering electric light bills a 20 per cent. discount for cash was allowed. This liberal discount caused the city electric light plant to run at a loss. Upon assuming office Mr. Mix remedied this at once, the present plan allowing no discount but granting the privilege of having burnt-out incandescent lamps renewed by the city free of charge.

As is the case in many cities and towns, the amount of water used per capita in Mishawaka is greatly in excess of what it should be. With a view of lessening the waste, the larger consumers are being required to install water meters. It is Mr. Mix's intention gradually to extend this system until all consumers are being served through meters. The water supply comes from the St. Joe river which runs through Mishawaka, but for drinking purposes it is not up to the standard. At present a number of deep wells are being driven and the supply will soon be derived from these.

The bookkeeping of the water works and electric plant has not been satisfactory in the past, and Mr. Mix is now completing arrangements whereby the accounts of both these plants will be in charge of the city clerk, whose salary will be commensurate with his new duties.

Mr. Mix is also endeavoring to better the system of garbage collection. At present this work is being done by a private contractor with the usual result that only a small percentage of the population have their garbage regularly removed. The mayor has been investigating this question of garbage disposal for smaller cities of late, and undoubtedly a betterment of conditions will soon follow.

In less than two months of his term of office Mr. Mix has placed much of the city government on a business basis and effected several reforms. In the conduct of city affairs he is applying the same methods which enabled him to treble the volume of his company's business during the first few years of his management, and demonstrating the value of the business man in local politics.

Technical Meetings.

The Tennessee League of Municipalities met in annual session in Nashville Oct. 8. Officers were elected as follows: President, Mayor J. M. Head of Nashville, re-elected; first vice-president, W. A. Fowlkes, jr., Mayor of Dyersburg; second vice-president, A. M. McClaire, Mayor of Lebanon; third vice-president, E. Yoest, Mayor of Columbia; secretary-treasurer, James W. Blackmore, Mayor of Gallatin, re-elected. The next meeting will be held in Nashville.

The National convention of the Iowa League of Municipalities was held at Iowa City, Ia., Oct. 8 and 9. Some of the papers presented were as follows: "Street Paving in Iowa," Mayor F. M. Norris, Mason City; "Some Recent Sewage Disposal Plants in Iowa," Prof. A. Marston of Iowa State College; "Governing a Municipality," Mayor W. H. Schooley, Indi-

anola; "Sources of Artesian Water Supply for Iowa Cities," Prof. S. Calvin of the University of Iowa.

The twenty-first annual convention of the American Street Railway Association was held in Detroit, Mich., Oct. 8, 9 and 10. Officers were elected as follows: President, J. C. Hutchins, Detroit; first vice-president, W. Carl Ely, Buffalo; second vice-president, W. K. Schoeph, Cincinnati; third vice-president, P. S. Arkwright, Atlanta; secretary and treasurer, T. C. Penington, Chicago. The association instructed the executive committee to visit Chattanooga and learn whether or not adequate facilities could be obtained for holding the next convention there before accepting that city's invitation.

The Engineering Association of the South held its regular monthly meeting in Nashville Oct. 9. A paper on the recently completed water works system at Phoenix, Ala., was read by Conrad H. Ohme of Birmingham. Officers will be elected at the next meeting, Nov. 13.

The convention of the Georgia League of Municipalities was held at Atlanta, Oct. 14 and 15. A committee on street paving was appointed as follows: Jacob Phinizy, Augusta; L. M. Campbell, Columbus; Herman Meyers, Savannah. Officers were elected as follows: President, Bridges Smith, Macon; first vice-president, L. H. Campbell, Columbus; second vice-president, J. F. Rhodes, Athens; third vice-president, P. H. Lovejoy, Americus; fourth vice-president John B. Felder, Americus; secretary, D. J. Bailey, Griffin; treasurer, W. B. Hollingsworth, Fayetteville.

The convention of the American Gas Light Association was held in New York City, Oct. 15, 16 and 17. Officers were elected as follows: President, Alten S. Miller; vice-presidents Rollin Morriss, Edward G. Cowdery and C. F. Pritchard; secretary and treasurer, Alfred E. Forstall.

The regular meeting of the Pacific Northwest Society of Engineers was held Oct. 11, when J. E. Blackwell presented a paper on "The Use of Concrete," George F. Cotterill, secretary, Seattle, Wash.

The annual convention of the Ohio Electric Light Association was held at Columbus, O., Oct. 14, 15 and 16. Some of the papers presented were: "What Is the Present State of Meter Development?" "How Shall We Handle Our Meter Department to Obtain Least Cost of Operation, Least Disturbance to Consumers and Maximum Efficiency?" "Hot Water vs. Steam Heating as an Adjunct to all Electric Light Plants," "Constant Current Transformer System," "The Reliability, Power Factor and Efficiency of Present Forms of Alternating Current Series Arc Lighting Apparatus," "Variable Secondary Step-up Transformer System." Officers were elected as follows: President, A. W. Field, Columbus; vice-president, S. M. Rust, Piqua; secretary and treasurer, J. H. Perkins, Youngstown. Columbus was selected for the next annual meeting.

The seventh annual convention of the National Brick Manufacturers' Association will be held in Boston, Feb. 2 to 7, 1903. George M. Fiske, president; George A. Randall, secretary.

The board of directors of the Michigan Engineering Society, at its annual meeting, elected officers as follows: President, Prof. M. E. Cooley, Ann Arbor; vice-president, A. L. Holmes, Grand Rapids; secretary and treasurer, F. Hodgman, re-elected, Climax. The next annual convention of the society will be held at Battle Creek, Jan. 20, 21, and 22.

The program of the meeting of the Municipal League of Indiana, to be held at Madison Nov. 12, 13 and 14, has been issued. It is arranged in the manner which has proved successful in former meetings with informal separate meetings of mayors, clerks, treasurers, councilmen, city attorneys, engineers and police officers the first evening, followed by a general meeting without a program.

During the second day the topics for discussion are "Municipal Ownership," "Constitutional Limitation of Indebtedness," "Municipal Government from a Business Standpoint," "Street Improvement Problems" and "Police Officers," followed by a banquet on an Ohio river steamer. As usual the papers are largely by mayors and city attorneys, as their public and private duties are likely to fit them most thoroughly to express themselves at such meetings. The officers of the convention are:

President, George E. Downey, ex-mayor, Aurora; first vice-president, E. D. McGuire, ex-mayor, Madison; secretary, George F. Harper, city clerk, Madison; treasurer, L. W. Mellett, ex-city attorney, Elwood.

Personal Notes.

Howard Smith has been appointed city engineer at Rochelle, Ill.

Herbert Conant has been appointed town engineer at Attleboro, Mass.

John B. Titcomb, Amesbury, Mass., has been appointed city engineer at St. Petersburg, Fla.

Ernest George Rutty, vice-president of Warren Brothers' Company, Boston, Mass., died Oct. 6.

Vernon P. Mace has been appointed water commissioner at Lestershire, N. Y., succeeding Frank L. Foatz.

Charles H. Sherman has resigned his position as superintendent of the water department at Plymouth, Mass.

James A. Armberg, jr., has been appointed city engineer at Memphis, Tenn., to succeed A. T. Bell, resigned.

Walter Brown, Columbus O., has been elected county surveyor of Franklin county, succeeding Henry Maetzel.

A. T. Bell, who has been city engineer of Memphis for twenty years, has resigned his position on account of ill health.

J. K. Wilkes has been appointed chief engineer of sewers at New Rochelle, N. Y., to succeed L. E. Van Etten, resigned.

James W. Johnson has resigned his position as city engineer of Riverside, Cal. Mr. Johnson has held the office for fourteen years.

Archibald Reeves, who for several years was assistant city engineer at Dayton, O., died at his home in that city, Oct. 2, aged thirty-seven years.

A. W. Smith, formerly city engineer at Kokomo, Ind., has been appointed deputy county surveyor of Miami county, Indiana, with headquarters in Peru.

Nicholas S. Hill, jr., has been appointed chief engineer of the department of water supply, gas and electricity, New York City, to succeed George W. Birdsall.

Willis F. Brown, Toledo, O., has been commissioned to conduct the final survey of the route to be traversed by the new People's Rapid Transit Electric Railway.

George H. Mendell, M. Am. Soc. C. E., col. corps of engineers, U. S. A., retired, and president of the board of public works at San Francisco, Cal., died Oct. 19.

John B. Heim, the efficient superintendent of the water works plant at Madison, Wis., has been re-elected to his position by the new board of water commissioners.

Robert Stockton, assistant to the president, and Frank Moses, assistant to the chief engineer of the South Jersey Gas, Electric and Traction Company, Camden, N. J., have resigned.

Alten S. Miller, consulting engineer of the Consolidated Gas Company, New York City, has been appointed general manager of the Consolidated Gas Company, Baltimore, Md.

Albert S. Crane, M. Am. Soc. C. E., has resigned his position as chief engineer of the Lake Superior Power Company, Sault Ste. Marie, Ont., to accept one as assistant chief engineer of the Chicago Sanitary district.

New presiding officers have been elected by both boards of the Louisville general council. Paul C. Barth is president of the upper board and Samuel S. Blitz is president of the lower board.

H. S. Burroughs has withdrawn from the firm of Ballantyne & Evans and has established an office at 27 William-st., New York City, where he will practice electrical and mechanical engineering.

James J. Ryan, formerly city engineer at Muscatine, Iowa, and James E. Bradford have formed a partnership for general engineering work and have established an office in the Olds Opera House block, Muscatine.

Beekman C. Little has been appointed superintendent of the water works system at Rochester, New York, to succeed the late George A. Hotchkin. Mr. Little has been connected with the water works system as a civil enugineer for the past eleven years. He has made valuable electrolysis surveys for Rochester and will prove a competent head for this important department.

Fred W. Wenban has resigned his position as superintendent of the Newark Gas, Light and Fuel Company, at Newark, N. Y., to accept a position with the Madison County Gas and Electric Company at Oneida, N. Y.

Charles A. Budd has resigned his position in the estimating department of the American Bridge Company and has accepted a place in the designing department of the Brown Hoisting & Machine Company, Cleveland, O.

P. C. Brennan, formerly superintendent of machinery for the Barber Asphalt Paving Company has established an office as consulting mechanical engineer at 18 Broadway, New York City. He will make a specialty of asphalt paving.

A. F. Doremus, state engineer of Utah, and F. C. Kelsey, former city engineer of Salt Lake City, have formed a partnership for the construction of water works and irrigation works, with offices in the McCormick block, Salt Lake City.

Fred W. Ames, former superintendent of police at Minneapolis, has been convicted of receiving bribes and sentenced to six years and a half in the penitentiary. A period of fifty days in which to move for a new trial has been granted.

George W. Birdsall has been appointed consulting engineer of the department of water supply and electricity at New York City. Mr. Birdsall has been connected with the water department of New York City for thirty-two years, twenty years of which he was its chief engineer.

Mr. Edwin D. Logsdon, who was elected third vice-president of the American Society of Municipal Improvements at the recent Rochester convention, is a prominent member of the Indianapolis board of public works. Mr. Logsdon has spent a number of years in the study of street and sidewalk construction and was connected with the Indianapolis fire department for a long time. This experience has well qualified him for the important position he holds at present.

Marshall O. Leighton, resident hydrographer of the United States government at Syracuse, and Prof. E. M. Chamont, representing Cornell University, will cooperate in making a scientific investigation of all the surface waters in New York state from a sanitary point of view. The object of the work is to arrive at certain facts regarding the quality of the water supply in central New York. The investigation will endeavor to determine the amount of pollution in the various water supplies and what is regarded as a normal amount of pollution.

The annual inspection and parade of the St. Louis police department took place recently, six hundred patrolmen and officers and fifty mounted men being in line. Medals were awarded for the greatest act of bravery during the past year, and for the best marksmanship with revolver. Twelve badges for honorable

mention were also presented, one to a man from each of the districts. Mayor Wells paid high tribute to the efficiency of the force, and a flag presented by the Veiled Prophet was given to chief of Police Kiely in token of his services in handling the immense crowds during the Prophet's visits.

J. D. Fate, president of the J. D. Fate Company, manufacturers of the Plymouth line of clayworking machinery, died at his home in Plymouth, O., Sept. 29, aged fifty-four years. Mr. Fate first embarked in business, associated with E. M. Freese and Mr. Wilson in the manufacture of a machine for making brick and tile. They organized under the firm name of Fate, Freeze & Wilson. In 1890 Mr. Fate retired and the business was continued by E. M. Freese & Co. In 1891 E. M. Freese removed to Galion, O., and Mr. Fate organized the Fate-Gunsaulus Company and continued the manufacture of the same line of machinery. The firm was changed in 1898 to J. D. Fate & Co. In April, 1902, it was reorganized under the name of the J. D. Fate Company.

L. F. Perdue of Terre Haute is one of the contractors in the state of Indiana who thinks the law regarding the letting of contracts for public works and payment for the same is not satisfactory. Not only must they give double bond for satisfactory performance, but they must await the pleasure of the authorities for payment, since no step can be taken toward collecting for the work and payment of the contractor until council or board has acted. Sixty days after completion and acceptance is the least time a contractor must wait and frequently he must wait four to six months. Mr. Perdue would like to know what other Indiana contractors think of an effort with the legislature to modify these provisions of the law.

George A. Parker, superintendent of Keny Park, Hartford, Conn., has been collecting and compiling park reports and valuable park statistics for a number of years and now possesses the most extensive library of this class of literature in the world. Mr. Parker is an enthusiast in this labor of love, his object being to preserves it in such a complete and practical shape that it shall be readily available for reference or educational uses. The library, which is rapidly growing, now almost fills two large rooms. Everything is classified in the most systematic manner. Mr. Parker is chairman of the committee of the American Park and Outdoor Art Association on Park Census and is also secretary of the Association of New England Park Superintendents.

Norman B. Livermore & Co., of 320 Sansome-st., San Francisco, Cal., have been appointed sole agents for the Scaife and We-Fu-Go Water Softening and Purifying systems for the Pacific coast, by William B. Scailf & Sons Company of Pittsburg, Pa., who are tthe sole manufacturers of these systems. Norman B. Livermore, the organizer of tfhe firm of Norman B. Livermore & Co., is an engineering graduate of Cornell University, who after a number of years in general practice, has recently organized this company to conduct a general engineering business and to act as sales agent for special lines on the Pacific coast. This company will give the subject of water purification their special attention, and are abundantly able to furnish their clients with any details or information regarding either the Scaife or We-Fu-Go Softening and Purifying systems.

MACHINERY AND TRADE

The Morse-Boulger Refuse Destructor at Macy's Department Store, New York City.

A new refuse destructor has been installed at Macy's new department store at Broadway and Thirty-fourth-st., New York City, by the Morse-Boulger Company of 39 Courtland-st., New York, which is described as follows:

The destructor is placed on the boiler room floor of the building, and is connected with two Babcock & Wilcox boilers, one on either side. It is 20 feet long, 8 feet high, 8 feet wide; the interior walls built of special quality fire brick and the exterior of hard red brick, the whole construction being bound together by perpendicular buckstays, longitudinal thrust bars and angle irons. This destructor has a capacity of 75 to 100 cubic yards per day of light refuse, and of 2,000 to 3,000 lbs. of kitchen garbage. The furnace is charged with refuse through a special charging door on the front end of the furnace from a car holding 1 cubic yard

of material, which in delivering its contents seals the opening against the emission of smoke and gases. There is also provided a special charging hole on the top of the furnace for the garbage. Doors are placed for stoking and withdrawal of ashes.

The combustion chamber of the destructor is connected on either side with two 250 h. p. Babcock & Wilcox boilers, the flues controlled by heavy fire clay dampers. The smoke pipe leads to the main breeching from the boilers to the chimney. The heat from the destructor enters the fire boxes of the boilers at the side above the fire bars, and thus may be used as auxiliary for operating the boiler, or will supply all the heat needed during the time that the quantity of combustible refuse to be destroyed is largest.

The amount of refuse that will accumulate in a large establishment is so great as to be the equivalent to 3 to 5 tons of coal per day. It includes every variety of paper, straw, excelsior and other packing materials, boxes and barrels which are not used for repacking, sweepings from all the floors, and all other worthless substances which have usually to be removed and destroyed elsewhere.

The refuse from each floor of the building descends by two chutes to the sorting-room on the basement floor, which is cut off from the firing-room by a partition of steel plates with doors for the admission of the charging car. Thus the furnace is isolated, being enclosed on all sides by a fire proof partition of brick and steel.

The garbage from the kitchen and restaurant is destroyed as fast as produced; the whole operation is carried on without interference with any department, and the heat is converted to steam power without the use of other fuel. The furnace is operated by one man for feeding and stoking, the application of the heat being controlled by the engineers and firemen in the boiler-room.

The installation of this furnace is a demonstration of the fact that all the waste of large business establishments can be utilized within the building for obtaining steam power by the operation of a properly designed destructor which occupies small space and is not costly to construct.

This installation has attracted the attention of a great number of engineers and architects, and the Morse-Boulger Company has been asked to design and install destructors for other department stores in New York, Philadelphia, Boston and Washington, and also for some of the largest hotels in the same cities.

A SCOUT FOR REESE-HAMMOND FIRE BRICK CO.

A Hiawatha of Fire Brick.

A calendar decorated with the accompanying picture of "The Fire-Flashed Red Man" is sent by the Reese-Hammond Fire Brick Company of Bolivar, Pa., accompanied by his clever address "To the Tribes of the Universe," and the following extract shows the entertaining style in which his advertising story is told:

Far and near our scout is traveling,
O'er the prairie, through the forest;
Forth he goes to search the country
For the game and fruits of all lands
That will keep us o'er the winter
Busy working at our wigwams
On the Tygart's Valley river,
In the state of West Virginia.
Busy also at our wigwams

In the Juniata valley,
On the Pennsylvania railroad;
On the Susquehanna river,
In the lands of Clearfield county,
On the Conemaugh so tragic
At old Bolivar historic,
In the State of Pennsylvania,
Where the clouds curl from our smoke-stacks.
Busy making brick for market,
Busy mining coal to burn them,
Busy mining clay to make them,
Busy blasting rock to make them,
Busy burning lime to bond them,
Busy making molds to shape them;
Busy grinding, molding, pressing,
Busy burning, loading, shipping,
Busy filling orders sent us,
Busy hunting future orders
From our friends of old acquaintance,
From our friends of new acquaintance,
From the strangers of the Northland,
From the strangers of the Southland,
From the strangers of the Eastland,
From the strangers of the Westland.

The International Correspondence Schools.

The operators of the "Correspondence Institute of America" were arrested Oct. 15, charged with fraudulent use of the mails. It was located at Scranton, Pa., the home of the long-established "International Correspondence Schools," with which it had no connection and with which it should not be confounded.

The "International Correspondence Schools" of Scranton, Pa., have built up a reputation for good work and fair dealing which has led to many imitations. They are the originators of this method of instruction, and our readers will not apply any of the information regarding failures of their imitators to them. The recognition of their value is becoming more widespread each year.

A Park Pavilion of Granilite.

We present herewith a picture of a pavilion designed by Theodore Alfred Leisen, M. Am. Soc. C. E., the engineer of parks, and constructed by the Standard Stone Company of 140 Nassau-st., New York, in beautiful Brandywine Park, at Wilmington, Del.

This structure is another triumph for cement-concrete construction. It is one of the finest examples of the great possibilities of this marvelous product erected in modern times.

GRANILITE PAVILION IN PARK AT WILMINGTON, DEL.

The pavilion occupies a prominent site on the north bank of the historic Brandywine river at the edge of a rock cliff, nearly 100 feet above the river bed and commanding a beautiful vista up the valley and surrounding country. The building, as will be seen from the illustration, is circular in form, thirty-five feet in diameter and thirty-three feet high, the whole structure being of "Granilite," the new and perfect stone. The dome is hemispherical in form, supported upon ten columns. The columns, frieze and cornice were all cast in sand molds in place, the roof proper being built of coarse concrete, but finished inside and out with the finer granilite composition, forming, in reality, a monolithic structure, the whole being reinforced with steel members where deemed necessary to obtain the requisite amount of strength. The construction was carried out under the process pat-

ented by Jacob C. McClenahan, who, as representative of the constructors, had charge of the work. Like the famous temples of the ancients, built out of concrete, this little "Pantheon" will doubtless endure for many generations as a lasting tribute to the genius of the twentieth century.

Some Recent "Continental Jewell" Filtration and Water Softening Plants.

The western branch of the New York Continental Jewell Filtration company, located at Chicago, Ill., has recently closed contracts for several plants. One at Carthage, Mo., has 2,000,000 gallons capacity. It is a gravity plant, allowing for six hours' subsidence. The filters are "Continental Jewell" type, with air wash, and are constructed of steel in 15x8 feet units. The clear well is about 100,000 gallons capacity. It is of concrete and is located under the filters. Other 2,000,000-gallon plants are contracted for at Freeport and at Pontiac, Ill. One of 3,000,000 gallons' capacity will be erected at Danville, Ill., It will be a concrete plant and we hope to have an illustrated description of it when completed. Other water works filter plants recently contracted for are to be constructed for the Camden Water, Light and Ice company, Camden, S. C., and the United States Government at the Presidio, San Francisco, Cal.

Water softening plants will be constructed for the Cincinnati, Lawrenceburg & Aurora Electric Street Railway Company at North Bend, O.; the Lackawanna Iron and Steel Company, at Lebanon, Pa., and the Chicago & Eastern Illinois Railroad Company; plants installed at Villa Grove, Holland, Salem, Marion, St. Elmo, Benton and Cypress, Ill.

Still other plants are under contract for the California & Hawaiian Sugar Company, Crockett, Cal., and the John Ramming Machine Works, St. Louis, Mo.

Scaife and We-Fu-Go Filtering and Water Softening Plants.

The Buffalo and Susquehanna Iron Company of Buffalo, N. Y., have contracted with William B. Scaife & Sons Company of Pittsburg, Pa., for a six-thousand horse-power We-Fu-Go water softening and purifying system. This is the third plant purchased by these people of the same kind, located at other points.

William B. Scaife & Son Company are receiving large contracts for both the Scaife and We-Fu-Go water softening and purifying systems, of which they are the sole manufacturers.

They have now in successful operation over 200,000 horse power in the United States alone, handling over 25,000,000 gallons of water daily, principally for boiler use, although a part of this amount is used in almost every industry where soft water is desirable.

Among some of their other recent sales are the following: Pennsylvania Salt Manufacturing Company, Wyandotte, Mich., 175 H. P.; Hecla Portland Cement and Coal Company, N. Bay City, Mich., 1,500 H. P.; Hecla Portland Cement and Coal Company, West Branch, Mich., 500 H. P.; the Toledo Furnace Company, Toledo, O., 3,750 H. P.; the National Mining Company, Sygan, Pa., 1,000 H. P.; Pittsburg Plate Glass Company, Elwood, Ind., 2,500 H. P.

The Keystone Coal and Coke Company of Greensburg, Pa., have contracted for a large filtering plant for their water works at Madison, Pa.

Among some of the other recent contracts taken by William B. Scaife & Sons Company for the Scaife and We-Fu-Go water filtering systems are the following: Union Steel Company, Donora, Pa., 500,000-gallon plant; the Lancaster Mills, Clinten, Mass., 1,000,000 gallon plant; W. D. Boyce Paper Company, Marcellus, Ill., 1,000,000-gallon plant; Thomas Phillips Company, Akron, O., 750,000-gallon plant; Gibson Manufacturing Company, Concord, N. C., 125,000-gallon plant; Carroll Hotel, Vicksburg, Miss., complete filtering system, and others.

Trade Publications.

The Wisconsin Graphite Company of Pittsburg, Pa., sends out two neat booklets, one representing a can of Wisconsin Flake Graphite and describing its uses as a lubricant, and the other entitled "A Life Preserver," setting forth the merits of their graphite paint. They are also price lists and are fully illustrated. Our readers who are interested in either product should send for copies of them.

The Christensen Engineering Company of Milwaukee, Wis., has recently issued three catalogues, one devoted to their straight air-brake equipments for electric railway cars, one showing the factories in which the air-brakes are made and giving a long list of patrons using them, and one listing the "Ceco" electrical machinery, including motors, generators and transformers. All three contain much valuable information aside from that pertaining only to the apparatus described.

The new chain catalogue No. 72 of the Jeffrey Manufacturing Company, Columbus, O., is now ready for distribution, and will be sent to all interested persons on application.

The Marinette Iron Works Manufacturing Company, whose Indianapolis, Ind., office is at 619 Stevenson building, suggests the "Walrath" gas or gasoline engine as "One Way to Overcome the Smoke Nuisance" in a circular with that title which is specially pertinent to the present conditions in Indianapolis, and applicable everywhere.

The catalogue of Harmon S. Palmer's patent hollow concrete building blocks and machines is a fully illustrated description of the blocks, the machines which make them and the buildings constructed of them, and shows the widespread use of the material in this form. Mr. Palmer's home address is Washington, D. C.

The Woodward Friction Water Wheel Governor is described in a circular issued by the Woodward Governor Company of Rockford, Ill.

The Foster Impact Engine and the Rife Hydraulic Engine for water works pumping stations are described and illustrated in a neat circular of the Power Specialty Company of 126 Liberty-st., New York.

The catalogue of the Pittsburg Blue Print Company, 1505 Park building, Pittsburg, Pa., shows the working of their electric blue printing apparatus, and gives price list of the various sizes and materials

Trade Notes.

ASPHALT.

The New Castle Asphalt Block company, Toledo, O., has secured a site at Point Edward, near Sarnia, Ont., and will establish a plant for manufacturing asphalt paving blocks. Davis & Anderson of Windsor are the Canadian representatives of the company.

An appropriation of $5,000 for the purchase of a municipal asphalt plant has been recommended at New Orleans, La.

BRICK.

A stock company is proposed at Red Wing, Minn., to manufacture common paving or pressed brick.

McHose Brothers of Grinnell, Ia., have purchased the brick and tile plant of J. B. McHose at Boone, Ia., for about $14,000.

The establishment of a shale brick plant at Willard, Kas., is contemplated by F. C. Janes.

The Coaldale Paving Brick Company, Coaldale, Ala., the Tennessee Paving Brick Company, Robbins, Tenn., and the Virginia Paving Brick Company, Lynchburg, Va., have consolidated under the name of the Southern Clay Manufacturing Company, with headquarters in Chattanooga, Tenn. John W. Sibley, formerly president of the Coaldale Paving Brick Company, is general manager of the new company.

CEMENT.

The Raven Lake Portland Cement Company, Toronto, Ont., has secured the agency for making hollow cement blocks by the Palmer process and the right to use the system in Canada.

The Iowa Cement Brick Company, Sioux City, Ia., has been incorporated by Richard M. Dott, president; Wilbur C. McNeil, secretary; James W. Smith, treasurer and manager.

Sand and cement brick will be manufactured at Point Edward, Ont., by Gutteridge & Sullivan, who have patented a machine for that purpose.

The International Cement Company, a New Jersey corporation, controlled by a company of Pittsburg and Philadelphia men, has purchased a site at Elizabeth, Pa., and will erect large cement works. The offices of the company will be in Pittsburg.

Walter M. French, 36 Haller building, Seattle, Wash., writes that a company may be organized for the purpose of manufacturing Portland cement by the dry process if further investigation convinces the interested parties that the matter is practicable.

The United States Gypsum Company, Chicago, Ill., recorded a trust deed Oct. 21 to the Federal Trust and Savings bank to all the property owned by the company as security for a loan of $1,000,000 for twenty years at 5 per cent. The money will be used to extend the plants of the company, to enlarge and improve the business and to liquidate debts.

Willard J. Bell, Newaygo, Mich., has been granted a patent for a cement railway tie.

The Giant Cement and Plaster Company of St. Paul, Minn., has just been incorporated with a capital of $300,000, with officers as follows: President, M. P. Ryan, St. Paul; vice-president, George Williams; secretary, L. P. Van Norman, Minneapolis; treasurer, A. Green, St. Paul. The company proposes to install a plant at Sabula, Ia., for manufacturing hydraulic cement and plaster, and one at St. Paul for manufacturing Portland cement. L. P. Van Dorman, secretary, 418 Guaranty building, Minneapolis.

LIGHTING.

Newly incorporated lighting companies: Zanesville Railway, Light and Power Company, Zanesville, O.; Municipal Light and Power Company, Jersey City, N. J.; Marseilles Water and Light Company, Marseilles, Ill.; St. Anthony Hill Electric Company, St. Paul, Minn.; Camp Electric Construction Company, New York City; Perfect Light Company, Jersey City, N. J.; Toledo Water and Electric Light Company, Toledo, Ore.; Erbon Heating and Electric Company, Wilmington, Del.; Capital Electric Company, Denver, Col.

The Camp Electric Construction Company, New York City, has been incorporated by C. F. Camp and F. E. Southard of New York City and Alexander Gregory of Brooklyn.

The Electric Arts Company, New York City, has been incorporated to conduct

electrical contracting by H. G. Carleton and C. E. Danforth, jr., of New York City and H. H. Pratt of Westfield, N. J.

MISCELLANEOUS.

The New York Continental Jewell Filtration Company, 15 Broad-st., New York City, is erecting extensive filter plants for the Charleston Light and Power Company, Charleston, S. C.; Chester, S. C.; Carnegie Steel Company, Munhall, Pa.; Iroquois apartment house, Pittsburg, Pa., and several others.

The Decatur Bridge Company is being organized by W. M. Wood, George A. Caldwell, Edgar B. Tyler and Thomas L. Blackburn, all of Muncie, Ind., and formerly connected with the Indiana Bridge Company. A plant will be established at Decatur, Ill., and the company will manufacture iron and steel and do construction work.

The plant of the American Bridge Company at Trenton, N. J., is to be enlarged and improved.

The Cleveland Car Company, Cleveland, O., is erecting large wooden car shops upon several acres of land 5 mis. west of the Cleveland Union depot on the Lake Shore railroad, at the junction of Lorain-st., known as West Park Post office, Cleveland. The company is equipping the shops with the most modern and up-to-date machinery for the manufacture of dump, grade and cement cars.

The Herbert Drain Tile Company, Herbst, Grant county, Ohio, has been incorporated by John Prior, John B. Reed, J. W. Eakins, H. C. Shobe and J. W. [redacted]

Rust. The tile factory of John Rust has been purchased and the company will begin the operation of the same at once.

The brick and tile plant of McCabe & Son, Rushville, Ill., has been purchased by Charles Ritchey.

The Enameled Steel Sign Company of Chicago, Ill., has been incorporated to manufacture enameled signs by Manley H. Simmons, Frank E. Smith and Alfred P. Tompkins.

The Austin Manufacturing Company of Chicago is building the mammoth stone crushers with from 1,500 to 2,000 tons capacity per day, at Split Rock, N. Y., for the Solvay Process Company of Solvay, N. Y.

The Studebaker Manufacturing Company of South Bend, Ind., will build a nine-story building at Thirteenth and Hickory-sts.

Recent Inventions.

707,788. Aug. 26, 1902. Composition of matter. John Murphy, Columbus, O. Consisting of crushed hard iron slag, pulverized high-limed cinders, Portland cement, liquor of flint and water.

707,921. Aug. 26, 1902. Machinery for making slabs with plain or ornamental surfaces of plastic cement or composition. G. B. Hall, London, England.

707,924. Aug. 26, 1902. Ceiling structure composed of beton and iron. Francois Hennebique, Paris, France. Two series of concrete beams crossing each other, metal rods and metal stirrups imbedded in the beams.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Oneida, N. Y.—Cement cross walks are being constructed in Loucks-st., at the intersection of Cherry-st., as an experiment.

Arcola, Ill.—Judge William H. Bassett handed down a decision, Oct. 15, denying the prayer of the petitioners asking that one of the main residence streets be paved.

Chicago, Ill.—Ernest McGaffey, Albert Schoenbeck and Charles Vapicka, members of the board of local improvements, visited Kentucky recently to examine the deposit of rock asphalt.

Chicago, Ill.—Ordinances were introduced Oct. 21 providing for the protection of asphalt pavement. One provides that carettes shall be equipped with rubber tires and the other forbids teamsters from "tracking" the pavement by driving one wheel on the car track, thus forcing the other to help form a rut in the pavement.

Fond du Lac, Wis.—Mayor L. A. Bishop, cy. engr. E. B. Parsons and the members of the improvement committee visited Chicago Oct. 18 for the purpose of inspecting the various kinds of paving in that city.

Baltimore, Md.—The United States Wood Preserving Company made a proposition to the board of estimates Oct. 13 to pave the sections of North-ave., from Gay to Tenth-st. Walbrook, not already paved with smooth material, with wooden blocks for $470,831 to be paid for in ten yearly payments. Action on the proposition was deferred.

St. Louis, Mo.—The members of the Tenth Ward Improvement Association

claim that the ordinance before the board of public works providing for the paving of Chippewa-st., between California-ave. and Grant-st., with brick has been changed to read asphalt. A committee has been appointed to investigate the alleged substitution.

CONTEMPLATED WORK.

Plant City, Ala.—Paved streets are proposed.

Washington, D. C.—Eighth-st. S. E., is to be repaved.

Muscatine, Ia.—A new paving district has been created.

Hartford, Conn.—Newington-ave. will be macadamized.

Council Bluffs, Ia.—Mayor Morgan is in favor of grading and paving.

Greenville, O.—A petition is being considered for improving an alley.

Opelika, Ala.—Macadam paving is contemplated for the principal streets.

Lincoln, Ill.—The question of improving the streets is being discussed.

Lousiville, Ky.—Bids will be asked soon for paving Spring-st. with brick.

Ft. Dodge, Ia.—The residents on S. Eighth-st. have petitioned for paving.

Minneapolis, Minn.—The question of issuing $500,000 in bonds for paving will be voted on Nov. 4.

Jamestown, N. Y.—A petition is being circulated asking that Spring-st. be paved.

Santa Monica, Cal.—The question of paving Third-st. and Utah-ave. is being considered.

Florham Park, N. J.—The macadamizing of the roads is contemplated by the road committee.

Manchester, Conn.—Plans for macadamizing Main-st. will be considered at a special meeting.

Latonia, O.—The question of issuing $30,000 bonds for street improvements is being considered.

Alton, Ill.—Ordinances were adopted Oct. 11 for paving Bluff-st., from State to Main.

Chicopee, Mass.—The construction of a new state road on Chicopee-st. has been authorized.

Du Quoin, Ill.—Contracts will be let soon for paving Main and Division-sts. W. B. Hall, mayor.

Marseilles, Ill.—A petition is being circulated asking that Main-st. be paved. Mayor Stebbin.

Louisville, Ky.—The board of public works will ask for bids for building brick sidewalks on a number of streets.

Fresno, Cal.—Resolutions were adopted Oct. 13 for building cement walks on a number of streets. Mayor Stephens.

Columbus, Ga.—A resolution has been adopted for paving the sidewalks on Twelfth-st. Chmn. Camp of St. Com.

Lansdowne, Pa.—The question of issuing $24,000 bonds for street improvements will be voted on Nov. 4.

Red Oak, Ia.—A petition will be circulated at once asking that Second and W. First-sts. be paved with brick.

New Castle, Pa. The specifications for brick paving on Kurtz-st. have been changed so as to provide for cement curbing.

Columbus, O.—Resolutions were adopted Oct. 13 for building sidewalks in a number of streets.

Glassport, Pa.—The question of issuing bonds for street improvements will be voted on in November.

Los Angeles, Cal.—Bids will be asked at once for grading sidewalks and curbing on Pacific-ave., from Fifth to Eighth-sts.

Hamilton, O.—A petition is being circulated asking that S. Front-st., between the C., H. & I. railroad and Walnut-st., be paved.

Chattanooga, Tenn.—An effort will be made to have the asphalt pavement on E. Ninth-st., extended from Market to A or B-sts., this year.

Topeka, Kas.—A petition is being circulated for paving Western-ave., between Huntoon and Douthitt-sts.

Chelsea, Mass.—The sum of $1,200 for macadamizing Arlington-st. from Everett-ave. to Fifth-st. has been appropriated.

Baltimore, Md.—The improvement of the pavements on North-ave., between Greenmount and Madison-aves., is proposed.

Bloomington, Ill.—Cy. Engr. Folsom will prepare estimates of the cost of paving E. Grove-st. with asphalt.

Litchfield, Ill.—The city clerk has been directed to advertise for bids for constructing more than 5,000 ft. of sidewalks.

Ft. Dodge, Ia.—The council has directed that Twelfth-st. and Second-ave. north be paved with asphalt.

Pekin, Ill.—An ordinance was passed Oct. 13 for paving S. Fourth-st., from Elizabeth to Park-ave. Mayor Conzelman.

Canandaigua, N. Y.—Resolutions were passed Oct. 10 providing for the construction of about 30 mls of state roadways.

New Richmond, Wis.—Mayor Epley and the common council contemplate paving a number of streets with macadam next year.

Chester, Pa.—Resolutions were adopted Oct. 20 for building improved walks on Twelfth, Lincoln and Pennsylvania-aves.

Paducah, Ky.—The question of issuing $100,000 bonds for street improvements will be voted on in November. W. H. Patterson, cy. clk.

Newport, R. I.—The question of paving Broadway and Spring-st. with bituminous macadam will be voted on Nov. 4. David Stevens, cy. clk.

St. Louis, Mo.—The contract for the reconstruction of West Pine boulevard with bituminous macadam will be awarded about Nov. 1.

Riverside, Cal.—A resolution has been passed providing for grading and gravelling Chestnut-st., from Eighth to Thirteenth-st. George F. Seger, supt. sts.

Meadville, Pa.—An ordinance has been passed for paving Chestnut-st., from the eastern terminus of present asphalt block paving to Market-st.

Watertown, N. Y.—The construction of 18 mls. of highway under the Higbee-Armstrong law has been provided for by the board of supervisers.

Bloomington, Ill.—City Engineer Folsom

estimates the cost of asphalt paving of Fell-ave., between Empire-st. and University-ave., at $4,812.50.

Nashville, Tenn.—The residents on Broad-st., between the viaduct and West End-ave., are agitating the question of paving with bituminous macadam.

Cincinnati, O.—The city engineer was directed Oct. 18 to prepare plans and specifications for paving Reading-road, from Rockdale-ave. to Burnet-ave., with asphalt.

Tacoma, Wash.—Ordinance have been passed providing for the construction of sidewalks, curbs and gutters in a number of streets. F. B. Woodruff, cy. clk.

Marseilles, Ill.—An ordinance was passed Oct. 6 for constructing 5-ft. cement walks on Aurora and Illinois-sts. G. C. Stebbins, mayor; Geo. C. Nelson, cy. clk.

Lincoln, Ill.—The city attorney has been directed to prepare an ordinance providing for concrete walks. The alley between Kickapoo and McLean-sts. will be paved.

St. Joseph, Mo.—Bids will be asked soon for macadamizing Fourth-st., from Lafayette to Renick. This work was let about a year ago to Helsley Bros., who threw up the contract.

Michigan City, Ind.—A resolution was adopted Oct. 20 approving the plans and specifications for building walks on Boston, Franklin, Eighth, Pine, Cedar, Sixth and Spring-sts.

Washington, D. C.—The district commissioners have been requested to include in their forthcoming estimates to congress an item of $10,000 for macadamizing Nichols-ave.

LaSalle, Ill.—About 26,424 sq. yds. of brick paving on broken stone base, 12,157 lin. ft. of stone curbing and 10,860 cu. yds. of excavation is contemplated. E. J. Noonan, cy. engr.

Tacoma, Wash.—A resolution was introduced Oct. 22 providing for the construction of walks of cement or other permanent fire-proof material on Tacoma and Yakima-ave. and G-st.

Lebanon, Ind.—At the recent opening of bids for improving Bushby-st. only one bid was received, and it was rejected as too high. Bids will be asked again for the work next spring. J. W. Fulwider, cy. engr.

Seattle, Wash.—Specifications have been approved and bids authorized for concrete walks on Boreu, Spruce, Sixth and Fifth-aves. The city engineer's estimates for regrading and concrete walks on Denny-way is $26,850, and for improving Eleventh-ave. $2,300.

Indianapolis, Ind.—Resolutions were adopted Oct. 20 for the following improvements: Paving Southeastern-ave., from State-ave. to Rural-st., North, with flint rock macadam, with brick gutters; cement walks on Kentucky-ave. and Twentieth-st.; grading, graveling and rolling Jones-st., from West to Dakota, and New York-st., from Highland-ave. to Dorman-st., south; cement walks on Congress-ave., from Northwestern-ave. to Clifton-st., and Twentieth-st., from Cornell to Martindale-ave.

CONTRACTS TO BE LET.

Hammond, Ind.—Bids are asked until Nov. 4 for macadamizing five streets. W. F. Bridge, cy. engr.

Sullivan, Ind.—Bids are asked until Nov. 11 for building about two miles of gravel road. J. M. Lang, co. audt.

Delphi, Ind.—Bids are asked until 1 p. m., Dec. 1, for building the Burlington and Cutler gravel road. Bd. co. comrs.

Akron, O.—Bids are asked until Nov. 15 for paving W. Market-st. with brick, with stone curbing and gutter. Chas. H. Isbell, cy. clk.

Cincinnati, O.—Bids are asked until Nov. 12 for grading, flagging and macadamizing Cloon-st. and Mansion-place. Robt. Allison, president b. p. s.

Indianapolis, Ind.—Sealed bids are asked until 10 a. m. Nov. 10 for grading and graveling New York-st., from Tacoma to Beville-ave., and Arsenal-ave., from Sixteenth to Nineteenth-sts. Harold C. McGrew, chmn. b. p. w.

Bluffton, Ind.—Sea'ed bids are asked until 7:30 p. m. Nov. 5 for asphalt, brick blocks or bituminous macadam paving, cement walks and drainage systems on S. Market and Cherry-sts.

Connersville, Ind.—Sealed bids are asked until 7:30 p. m. Nov. 3 for paving the alley crossways with vitrified paving brick or block, on gravel foundation and sand cushion, with marginal stone. Carl Hansen, cy. engr.

Portsmouth, Va.—Sealed bids are asked until 8 p. m. Dec. 22 for about 45,000 sq. yds. of asphalt, block, brick, granite block and bituminous macadam paving. C. W. Walker, chmn. st. com.; Bascom Sykes, cy. engr.

CONTRACTS AWARDED.

Morgantown, W. Va.—A paving contract has been awarded to Dean & Hoffman.

Topeka, Kas.—The contract for macadamizing W. Sixth-st. was let to Ramsey & Ramsey at 38¾ cts. a sq. yd.

Oakland, Cal.—Stone Bros. secured the contract for macadamizing 5,000 ft. of the Redwood road for $3,125.

Kansas City, Kas.—The Parker-Washington Company was awarded two asphalt paving contracts Oct. 11 at $2.09 a sq. yd.

Chicago Heights, Ill.—The contract for macadamizing Fourteenth-st. was awarded, Oct. 13, to Wm. McGrew at $1.26 a lin. ft.

Towson, Md.—The contract for building 5 mls. of road has been awarded to Thos. J. Harden of Baltimore for $5,000.

Sebring, O.—The contract for 5,800 sq. yds. of brick paving in this city was awarded to John Hadley, Canton, for $8,300.

Great Falls, Mont.—The contract for constructing the Second-ave., north, boulevard, was awarded, Oct. 20, to Henry Sheppard for $4,347.

Lead, S. D.—John McDonald of Duluth, Minn., submitted the lowest bid for paving Main and Mill-sts. and will be awarded the contract.

Augusta, Ga.—W. F. Bowe was awarded the contract for paving Washington-st., between Walker & Calhoun, with Belgian blocks for $7,000.

Toledo, O.—Garrigan Bros. were awarded the contract, Oct. 16, for paving Twenty-second-st., from Norwood-ave. to Monroe-st., with Logan block for $2,285.40.

Springfield, Ill.—The contract for paving Adams, Lewis and Spring-sts. with brick was awarded to John F. Bretz & Son of this city for $12,591.10.

Lorain, O.—The contracts for paving Washington-st., Fifth-ave. and Duane-st. were awarded, Oct. 20, to the Ohio Engineering Company. Metropolitan block will be used.

Great Falls, Mont.—The contract for constructing First-ave. S. boulevard, between Eleventh and Thirteenth-sts., was awarded, Oct. 13, to W. J. Martin.

Kearny, N. J.—The contract for paving Grant-ave., from the Erie railroad to Belgrove drive, with asphalt was awarded, Oct. 14, to the Barber Asphalt Paving Company

Milwaukee, Wis.—The contract for paving Market-st., from Biddle to Johnson with asphalt, was awarded Oct. 15 to the Western Paving and Supply company at $2.30 a sq. yd.

Jerseyville, Ill.—Wolf, Maupin & Curdie of Alton secured the contract for paving N. State-st., between Pearl and Exchange-sts. This company has the contract for paving Pearl-st.

Carthage, Ill.—The contract for paving around the square and the street leading to the depot with brick was awarded Oct. 15 to Thomas W. Sennott of Chicago at $1.33 a sq. yd., or $41,839.59.

Erie, Pa.—The contract for paving Twenty-fourth-st., from Peach to State, with old Medina stone, was awarded Oct. 16 to P. J. Wissler at 43 cts. a sq. yd. for laying the stone and 58 cts. a ft. for curbing.

Decatur, Ind.—The contract for paving Fourth-st. with brick on concrete has been awarded to Calvin Miller for $19,869, and for macadamizing two streets to W. P. Robinson for $2,463.

Newark, O.—Baldwin Bros. & Graham of Columbus submitted the lowest bid Oct. 13 for curbing and paving Elm-st., from Locust-st. to Log Pond run, at $1.12 a sq. yd. for Bolen block on gravel foundation.

Springfield, Mo.—Paving contracts were awarded Oct. 20 as follows: Reconstructing pavement on Boonville-st., George Bowman, $1,580; paving Springfield-ave., E. Plummer, $1,694.70; paving High-st., R. Hart, $2,375.

Washington, Pa.—Contracts were awarded Oct. 6 for 116,946.5 sq. yds. of paving and 38,712.5 sq. yds. of grading, as follows: R. T. Hallam & Sons, twenty-eight streets; Pickett & Co., two streets; Park Paving Company, nine streets.

Connersville, Ind.—The constructing of 125,000 sq. ft. of cement walks, 4,000 lin. ft. combined curb and gutter, 5,500 ft. gravel roadway and 500 ft. of 12 in. sewer with inlets was awarded to Williams Bros. of this city.

Louisville, Ky.—The Green River Asphalt Company was awarded the contract Oct. 6 for reconstructing E. Broadway, from the entrance of Cavehill cemetery to Highland-ave., 1,300 ft., at $1.40 a sq. yd. The city will furnish the concrete.

Burlington, Ia.—George Kreichbaum submitted the lowest bid Oct. 6 for brick paving as follows: Main-st., paving, $1.35 a sq. yd.; curbing, 55 cents a lin. ft.; grading, 40 cents a cu. yd. Valley-st., paving, $1.80; curbing, 75 cents; grading, 45 cents.

Seattle, Wash.—Contracts were awarded Oct. 20 as follows: Concrete walks on Sixth-ave., Coast Concrete Company, $1,718.66; Spruce-st., T. Ryan & Co., $3,742.80; Beacon-ave., T. I. Peterson, $1,591.80; Boren-ave., T. Ryan & Co., $2,335.25.

Newton, N. J.—Contracts for building three sections of macadam roads were awarded as follows: road from Sussex to Newton, McKarnan & Bergen, Paterson, $6,611; from Stanhope to Newton, Augustus Munson Company, Rockaway, $7,807; from Sparta to Newton, McKernan & Bergen, Paterson, $4,406.

Kansas City, Mo.—Contracts for street paving have been awarded as follows: St. John & Windsor-sts., Gilsonite Roofing and Paving Company, $28,089; Washington and Central-sts., Parker-Washington Paving Company, $7,316; Thirteenth-st., Barber Asphalt Paving Company, $8,681.

Irvington, N. J.—The contract for flagging W. Clinton-ave., from Wall to Sanford-st. was awarded Oct. 14 to Henry Schreitmuller of this city at 13¾ cts. a sq. ft. The bid of Philip Keach who offered to furnish and lay crosswalks, of second grade stone, at 75 cts. a sq. ft. was accepted.

Niagara Falls, N. Y.—(Special.)—Contracts for paving have been awarded as follows: Asphalt—Barber Asphalt Paving Company, Eleventh-st., 1,600 sq. yds., $4,468; Fourth-st., 2,925 sq. yds., $7,475; Fifth-st., 2,206 sq. yds., $5,736. Brick—John F. Speicher, city, Thirteenth-st., 2,020 sq. yds., $5,017.

Erie, Pa.—Bids were received Oct. 13 for paving as follows: Sixteenth-st., brick, V. D. Eichenlaub, $1.76 a sq. yd. for Mack or Park brick. John McCormick & Son, $1.74 for Park and $1.76 for Mack brick. Mayer Bros., $1.68 for Advance brick. Peach-st., asphalt, Mayer Bros., $2.24 a sq. yd.; Barber Asphalt Paving Company of Buffalo, $2.50. Action on both contracts was deferred until Oct. 30.

Pittsburg, Pa.—Contracts for building nine county roads have been awarded as follows: Booth & Flinn, Ltd.—Washington Pike, $63,676; Dravosburg road, $105,692; Noblestown road, $65,200; Glenfield road, $96,344; Keeling and Ridge—Freeport road, section 1, $77,095; Evergreen extension, $78,380; Foley Bros.—Noble lane road, $19,170; J. C. McSpadden—Natrona branch road, $14,328; Bull creek road, $87,107.

Boston, Mass.—Bids were received Oct. 21 for constructing Bennington boulevard, East Boston, as follows: Metropolitan Construction Company, $53,168; Jones & Meehan, $43,991; Jas. Doherty, $35,917; John O'Brien, $36,661; McGawley & Coughlan, $41,101; Patrick McGovern, $40,829;

Coleman Bros., $38,392; Thomas F. Welsh, $51,503; J. J. Sullivan, $49,893; W. H. Ellis, $44,993; Bruce, Salamone & Petitte, $62,479. The work will consist of macadam roadways on Telford base with loam spaces in the center of the boulevard. Bids were received from local contractors only.

Winnipeg, Man.—The city council has authorized an expenditure of $15,000 for improving the water works system.

Portland, Me.—The formation of a water district preliminary to the municipal ownership of water works is proposed.

Jamestown, N. J.—This city will issue $600,000 bonds Jan. 1 to purchase the plant of the Jamestown Water Supply Company.

Watertown, N. Y.—Surveys are being made to determine the feasibility of obtaining a water supply from Crystal lake.

Youngstown, O.—A proposition is before the city council providing for an expenditure of $250,000 for a filtration plant.

Groveland, Mass.—It is believed that a water supply and sewerage may be secured by the annexation of this town to Haverhill.

Mena, Ark.—Bids will be asked about Dec. 15 for the proposed municipal water works plant. John N. Hamilton, secy. W. W. Comrs.

Montclair, Col.—The question of granting a twenty-year franchise to the Montclair Improvement Company will be voted on Nov. 20.

Springfield, Ill.—Mayor Phillips has advertised for bids for furnishing 3,500 to 4,000 water meters of uniform pattern and various sizes.

Salt Lake City, Utah.—Frank Hines, water supt., urges the introduction of the meter system as the best means of effecting a saving of the water.

North Hempstead, N. Y.—A petition has been presented to the town board asking that a water supply district with street hydrants be established.

Des Moines, Ia.—The bids were received Nov. 22 for paving E. Walnut, Fifth, Twelfth and Maple-sts. with asphalt as follows: Barber Asphalt Paving Company—Walnut-st., $1.96 a sq. yd; Fifth-st., $1.50; Twelfth-st., $1.97½; Maple-st., $1.50. Andrew Jaicks—Walnut, $1.99; Fifth, $1.70; Twelfth, $1.99; Maple, $1.70. Western Construction Company—Walnut, $2.07; Fifth, $1.77; Twelfth, $2.07; Maple, $1.77. Contracts for brick paving were awarded Oct. 24 as follows: O. P. Herrick, State-st., $1.69; Bennett Bros., an alley, $1.73.

Buffalo, N. Y.—(Special)—Bids were submitted Oct. 22 for paving the Hamburg turnpike from the Buffalo river to the city ship canal, 9,410 sq. yds., as follows: Asphalt—Barber Asphalt Paving Company, $28,042; German Rock Asphalt and Cement Company, $33,000; Warner-Quinlan Asphalt Company, $33,230; H. P. Burgard, $28,000; Eastern Construction Company, $31,000. Brick—H. P. Burgard, $32,000; F. V. E. Bardol, $32,000; Barber Asphalt Paving Company, $32,000. Medina sandstone—H. P. Burgard, $37,000; F. V. E. Bardol, $35,000; William H. Kinch, $33,000; Barber Asphalt Paving Company, $41,216. Bids were also opened for paving Louisiana-st., as follows: From Mackinaw to Sandusky-st., 1,796 sq. yds. Asphalt—German Rock Asphalt Company, $3,035; Barber Asphalt Paving Company, $2,766; Warner-Quinlan Asphalt Company, $3,835; Eastern Construction Company, $2,850; H. P. Burgard, $3,100. Brick—H. P. Burgard, $3,100; F. V. E. Bardol, $4,700; German Rock Asphalt Company, $3,930; Barber Asphalt Paving Company, $2,766. Medina Sandstone—Barber Asphalt Paving Company, $5,801; H. P. Burgard, $5,800; F. V. E. Bardol, $5,500; William H. Kinch, $5,900. Louisiana-st., from Hamburg Canal to Perry-st., 2,431 sq. yds. Asphalt—German Rock Asphalt and Cement Company, $3,860; Barber Asphalt Paving Company, $3,695; Eastern Construction Company, $3,500; Warner-Quinlan Company, $5,000; H. P. Burgard, $4,250. Brick—H. P. Burgard, $6,000; F. V. E. Bardol, $6,000; Barber Asphalt Paving Company, $4,911; German Rock Asphalt or Cement Company, $5,080. Medina Sandstone—F. V. E. Bardol, $7,150; Barber Asphalt Paving Company, $7,852; H. P. Burgard, $7,900; William Kinch, $7,700.

SEWERS.

D. E. McComb, superintendent of sewers, has submitted his annual report regarding the operations of the sewer division of the District Government to the District Commissioners. He estimates that the amount required to complete the project, in addition to the amounts heretofore appropriated, is $2,168,097.50. The expenditures to date on account of completed work aggregate $520,473.04. The appropriation to date on account of work in progress aggregates $1,814,000.

CONTEMPLATED WORK.

Melrose, Mass.—A sewer in Otis-st. is proposed.

Slayton, Minn.—A sewerage system is contemplated.

Groveland, Mass.—A sewerage system is contemplated.

Worcester, Mass.—A sewer will be built on Hollywood-st.

Jersey City, N. J.—A sewer in Harrison-ave. is proposed.

Bond Hill, O.—The construction of sewers is contemplated.

Durango, Mex.—Contracts will be let for building a sewerage system.

Springfield, O.—Ordinances were passed Oct. 21 for building three main sewers.

Jamestown, N. Y.—The extension of the sewerage system is contemplated at a cost of $43,000.

Pasadena, Cal.—A resolution has been passed to build a sewer in Holly-st. Herman Dyer, cy. clk.

Batavia, N. Y.—(Special.)—This city voted down the proposition, Oct. 27, to build a sewerage system at a cost of $375,000.

Laconia, N. H.—A sewerage system is proposed for the Camp Ground.

Gainsville, Ga.—A sewerage system is proposed. Mayor Parker.

Lenox, Mass.—The sum of $20,000 has been appropriated for sewers.

Doylestown, Pa.—The question of sewerage improvement is being considered.

Butler, Pa.—An ordinance has been passed for building a sewer in Mercer-st.

Oelwein, Ia.—Resolutions have been passed for building certain sewers.

Orion, Mich.—The village voted to issue bonds for completing the sewer.

Massena, N. Y.—Bids will be asked soon for building sewers. J. W. Webb, vil. clk.

Smithville, Tex.—A stock company is being formed for building a sewerage system.

Geneva, N. Y.—About 6,300 ft. of sewer will be built. W. S. Ward, cy. clk.

Bushnell, Ill.—The citizens have petitioned for the construction of a sewerage system.

Yonkers, N. Y.—The estimated cost of building the Saw-Mill sewerage system is $123,000.

Wichita, Kas.—Plans will be made for building storm water sewers. H. J. Harding, cy. engr.

Glassport, Pa.—The question of issuing bonds for building sewers will be voted on.

Elizabeth, N. C.—C. M. Ferebee has asked for a franchise to construct a sewerage system.

Du Quoin, Ill.—Plans are being prepared for building a sewerage system. W. B. Hall, mayor.

Meadville, Pa.—An ordinance passed second reading Oct. 15 for building a sewer in Liberty-st.

East Syracuse, N. Y.—This village voted to issue $55,000 bonds for building a sewerage system.

Atlanta, Ga.—The city council has issued $400,000 bonds for the extension of the sewerage system.

Racine, Wis.—The question of issuing $55,000 bonds for building nine sewers will be voted on Nov. 4.

Oakland, Cal.—An ordinance has been passed appropriating $150,000 for city work, including sewers.

Logansport, Ind.—The extension of the sewerage system is contemplated. Walter A. Osmer, cy. engr.

Portland, Mich.—The construction of sewers in Kent and Brush-sts. is contemplated. D. J. Joss, vil. clk.

McKeesport, Pa.—Ordinances have been passed for building sewers in Acheson and Powderly-sts. and Crooked Run.

Griffin, Ga.—An engineer will be engaged to make surveys and estimates for a new sewer system. Mayor Bailey.

Cape Charles, Va.—The city council has voted to employ an engineer to supervise the construction of a sewerage system.

Los Angeles, Cal.—Frank H. Olmstead has been engaged as consulting engineer in the construction of the proposed outfall sewer.

Canajoharie, N. Y.—This village voted Oct. 15 to build a sewer system at a cost of $35,000. J. C. Melick, vil. clk.

Bridgeport, Pa.—The question of issuing $25,000 bonds for constructing a complete sewerage system will be voted on Nov. 4.

Loveland, Col.—A resolution has been passed establishing sewerage district No. 1, which extends the entire length of the town.

Virginia, Minn.—A petition has been presented to the city council asking that preliminary steps be taken establishing a sewerage system.

Bessemer, Ala.—Contracts will probably be let about Nov. 4 for building additional storm sewers in Second-ave. district. W. J. Parker, cy. engr.

Ventura, Cal.—Resolutions have been passed to issue bonds as follows: Storm sewers, $22,500; sewer extension, $10,000; sidewalk construction, $5,000.

Ardmore, Pa.—The commissioner of Lower Merion township will submit to vote in February a proposition to borrow $250,000 for building a sewerage system.

Havre, Mont.—The government contemplates building a complete sewerage system at Ft. Assiniboine with a sewage disposal plant, according to press reports.

Crowley, La.—(Special.)—Armas Durio, supt. w. w. and electric light, says that about 12 miles of 8, 10, 12, 18 and 24-inch pipe sewers with fittings is contemplated.

Seneca Falls, N. Y.—The plans for fifteen miles of sewers are about completed and the question of issuing bonds will be voted on. G. N. Barlow, chmn. sewer com.

Topeka, Kas.—Petitions are being circulated asking that a new sewer district be created to include Dennis and Martin addition, Orchard Place and Walnut Grove.

Marshfield, Wis.—The board of public works will hear objections Nov. 19 on the proposed plan for sewerage for sections 4, 5, 6, 7 8, 9, 16, 17 and 18. E. E. Ames, chmn. B. P. W.

Chicago, Ill.—The city officials decided Oct. 23 upon plans for a sewerage system to drain the southwest part of the city. The plans provide for two systems which will cost $1,000,000.

Indianapolis, Ind.—No bids were received Oct. 24 for building sewers in Valley and Bloyd-aves. The contractors in this city say they cannot employ enough labor to complete the contracts they already have on hand.

Erie, Pa.—The board of trade adopted a resolution Oct. 10 indorsing the efforts of the Mill Creek commissioners and the city officials thus far to improve the condition of the city and abate the Mill Creek nuisance.

Washington, D. C.—The district commissioners have been asked to consider the construction of a sewer on Benning Road, from Sixteenth to Nineteenth-sts., and on Nineteenth-st., from the Benning Road northeast to connect with a trunk sewer.

Minneapolis, Minn.—The council sewer committee has authorized the city engineer to purchase 200,000 brick for the construction of additional sewers. The question of issuing bonds for building sewers will be voted on Nov. 4.

Emmetsburg, Ia.—(Special.)—Henry Kneer, supt. w. w., says that the city council contemplates building a sewerage system of about 8,000 or 9,000 feet of 20 to 30-in. sewers for main lines and about 7,000 to 8,000 ft. of 4 to 20-in. sewers for branch lines.

Buffalo, N. Y.—(Special.)—The department of public works has just completed surveys and plans for the improvement

of Buffalo river and Cazenovia creek. The improvement is for the purpose of abating the flooding of the South Buffalo district; estimated cost, $700,000.

Paterson, N. J.—At an informal meeting of the Citizens' Association, James Owen of Montclair, John R. Wise of Passaic and William Ferguson of this city, delivered addresses on sewage disposal. Mr. Owen advised the city to secure the services of an unbiased expert to go over the entire ground, and that the city thereupon act upon his suggestions.

CONTRACTS TO BE LET.

Davenport, Ia.—Sealed bids are asked until 2 p. m. Nov. 4 for sewers in Prairie and Ninth-sts. Thos. Murray, cy. engr.

Jamesburg, N. J.—Bids are asked until Nov. 5 for building sewers at the State Home for Boys. Edward Spalth, prest. bd. trustees.

Bluffton, Ind.—Sealed bids are asked until 7:30 p. m. Nov. 5 for constructing drainage systems in South, Market and Cherry-sts.

Akron, O.—Bids are asked until Nov. 15 for building a main trunk sewer in sewer district No. 9 in Howe-st. Chas. H. Isbell, cy. clk.

Washington, D. C.—Bids are asked until Nov. 15 for constructing a portion of the Low Area trunk sewer. H. B. F. McFarland, chmn. dist. comrs.

Gueyden, La.—Sealed bids are asked until Nov. 4 for dredging work for improving drainage. W. D. Spencer, prest. bd. comrs. Gueydan drainage dist.

Oneida, N. Y.—Sealed bids will be received until 6 p. m. Nov. 11 for about 7,000 feet of 8 to 20 in. pipe sewers; average cut 15 ft., estimated cost, $24,000. W. E. Vedder, cy. engr.

Nashville, Tenn.—Sealed bids will be received until 3 p. m. Nov. 26 for constructing a circular brick sewer, 1 mi. in length, in Edgefield branch. Wm. W. Southgate, cy. engr.

Westfield, Mass.—Sealed bids are asked until Nov. 5 for building brick sewers as follows: 2,075 ft. 54 in., 2,980 ft. 48 in., 560 ft. 42 in., 335 ft. 36 in., and 60 ft. 30 in. brick sewers. Jas. H. Clark, chmn. com.

Roselle Park, N. J.—Sealed bids are asked until Nov. 8 for constructing a sewerage system, to include 5,900 ft. 15 in., 3,080 ft. 12 in., 4,120 ft. 10 in. and 32,870 ft. 8 in. pipe; 140 manholes, 27 flush tanks. A. M. Woodruff, boro clk.; J. Wallace Higgins, boro engr.

CONTRACTS AWARDED.

Bloomington, Ill.—R. R. McGregor was awarded a contract, Oct. 9, for a sewer in Lee-st. for $1,164.81.

Gouverneur, N. Y.—The contract for the Babcock-st. sewer was awarded to W. S. Corbin for $1,900.

Schenectady, N. Y.—Beckwith Bros. secured the contract for a sewer through Broadway Hill for $5,409.

Laramie, Wyo.—F. Joslin of Cheyenne was awarded the contract for the Warren-ave. storm sewer for $7,827.

Niagara Falls, N. Y.—The contract for a sewer in Eighteenth-st. was awarded, Oct. 18, to W. R. Cookman for $2,197.50.

Morgantown, W. Va.—The contract for building new sewers was awarded, Oct. 3, to Dean & Hoffman for about $15,000.

Grand Forks, N. D.—The contract for constructing a county ditch 18 miles long was awarded to P. McDonald of Duluth for $28,000.

Cheyenne, Wyo.—The contract for building one mile of storm sewer in Warren-ave. was awarded Oct. 22 to Frank Joslin for $7,826.24.

Lagrange, Ga.—The contract for building a sewerage system was awarded to Moore & McCrarey of Atlanta for $15,000.

Cass Lake, Minn.—The contract for extending the sewerage system has been awarded to Pastoret & Martin of Two Harbors for $7,474.

Yonkers, N. Y.—The contract for a sewer in McLean-ave. and S. Broadway has been awarded to Molloy & Murray for $11,509.

Scranton, Pa.—The contract for building a sewer in the Nineteenth district was awarded, Oct. 6, to Ruch & Miller of Philadelphia for about $180,000.

Waukegan, Ill.—The contract for building a sewerage system in the south part of this city has been awarded to James Cape & Sons of Racine, Wis., for $23,183.

Cincinnati, O.—The contract for a sewer in Linwood-ave., from Delta-ave. to Observatory road was awarded, Oct. 19, to the F. H. Kirchner Company for $51,596.20.

Kalamazoo, Mich.—The contract for constructing a concrete sewer in Vine-st., from Portage to West, was awarded, Oct. 10, to H. P. Streieber of Toledo, O., for $9,486.75.

Akron, O.—Sewer contracts were awarded, Oct. 13, as follows: Building main trunk in district No. 10, John O'Neil, $6,600.78; sewer in Holloway-st., H. Kane, $1,294.91; Bell-st., J. J. McGowan, $1,250.90.

Newark, N. J.—The contract for building the fourth section of the joint sewer, extending from Millburn-ave., Millburn, through South Orange to the West Orange line, was awarded, Oct. 3, to J. P. Hall of Jersey City for $45,553.53.

La Crosse, Wis.—The contract for building 12-inch circular sewers on Johnson and Winnebago-sts. was awarded, Oct. 14, to Olaf Swensen, at 65 and 68 cents a foot, respectively, $39 for manholes, $34 for catch basins and $5.50 for house connections.

Newark, N J.—The contract for building section No. 6 of the joint outlet sewer was awarded Oct. 16 to the Harrison Construction Company of this city. The contract for the Millburn system was awarded Oct. 20 to Jas. Conway of this city for $44,750.

Boston, Mass.—The contract for building section 45 of the high-level sewer in Quincy was awarded Oct. 1 to Latta & Terry of Philadelphia for $68,372. The contract for section 78, high-level sewer, in Roxbury, was awarded to Patrick McGovern of Boston for $18,360.

Grand Rapids, Mich.—Bids were opened Oct. 17 for the construction of the West Side ditch trunk sewer. The bids were as follows: Albert Prange, city, $120,936.62, if concrete is used, and $120,936.62 if steel is combined with concrete; James

and Thomas P. McDermott, $124,114.94 for concrete and $124,468 for steel; Heinemann & Co., Chicago, $147,247.74.

Scranton, Pa.—(Special.)—Joseph P. Phillips, cy engr, says that the contract for constructing a system of sewers in the 19th district was awarded Oct. 6 to Ruch & Miller, 1345 Arch-st., Philadelphia, at $2.77¾ a lin. ft. for sewer complete with Pierce or other casting cover basin and full lining in tunnel. The work includes 64,805 lin. ft. of 8 to 63-in. brick and pipe sewers; 364 manholes; 7 tunnel manholes; 165 basins; 25,100 lin. ft. 6-in pipe for house connections; average depth of trench, 11 ft, about 20 per cent. rock and 80 per cent. earth excavation.

WATER-WORKS.

Jersey City, N. J.—The American Filtering Company was incorporated Oct. 13 by Samuel A. Lancier, Samuel Rudner and Samuel R. Bullock.

Ottumwa, Ia.—The supreme court decided Oct. 24 that this city may levy a tax for constructing a municipal water plant. The contract has been let.

Newly incorporated water companies: East St. Louis, Edgemont and Belleville Water Company., East St. Louis, Ill.; Oak Glen Water Company, San Bernardino, Cal.; Wachusett Mountain Spring Water and Realty Company, Jersey City, N. J.

Vernon, Ind.—The franchise of the Seymour Water Works Company was declared null and void in the Jennings circuit court Oct. 18, on the ground that because of its being a perpetual franchise it was against public policy, as it created a monopoly in preventing competition.

Grand Rapids, Mich.—City Attorney Taggart decided Oct. 16 that the bd. of pub. wks. cannot enter into a contract with any water company to obtain a universal system of water meters for local use, paying for them in installments reaching over a period of 10 years.

Camden, N. J.—The city reservoir near the Delaware river broke Oct. 2 and about 8,000,000 gallons of water escaped, flowing down Twenty-seventh-st., flooding the cellars of a number of houses and entailing other damage. The reservoir is 344 ft. long, 180 ft. wide and 21 ft. deep.

Cheney, Wash.—The committee appointed to investigate the advisability of purchasing the water plant reported in favor of the plant, saying that the water is pure and the plant in splendid condition. The report was adopted Oct. 20 and a special election will probably be called. L. H. Houck, mayor.

Texarkana, Tex.—The water works property was sold at auction Oct. 7 by Judge Rogers of the federal court. The works were purchased by Howard Barry for $76,000. The failure of the company to furnish a sufficient quantity of water to supply the public demand resulted in the appointment of a receiver, and finally the sale of the property.

Sedalia, Mo.—Suit was entered in the Pettis county court Oct. 6 against the Sedalia Water and Light Company, to cause the forfeiture of the defendant's franchise because of its alleged failure to comply with its contract with the city. The failure of the company to lay a pipe line from its pumping station and reservoir to Lake Tebo, which was to have been completed within three months from August, 1898, and its failure to provide wholesome water for its patrons are among the causes cited for the forfeiture of the charter.

Columbus, O.—Judge Bigger issued a temporary injunction against the city dam project Oct. 6 The injunction is against the sale of bonds and the carrying out of the contract to build the dam, which was awarded in August. Judge Bigger says the contract could not be legally let at the time it was awarded; that the bd. of pub. wks. approved the plans for the dam July 12, 1902; the city council passed the ordinance Aug. 4, ordering the contract to be made, and the bonds amounting to $285,000 to be sold; the board of public works awarded the contract Aug. 9, five days after the passage of the ordinance. The contract was let, therefore, six days before the ordinance could, under the law, take effect. It is also held that the bd. of pub. wks. is not authorized to make contracts for this improvement, but the director of public works is the proper party.

CONTEMPLATED WORK.

Sebree, Ky.—A water works system is contemplated.

Arlington, S. D.—This town voted to sink an artesian well.

Oelwein, Ia.—The purchase of a new pump has been decided upon.

Bucyrus, O.—The water mains will be extended on Clark and W. Warren-sts.

Enid, O. T.—This town voted to issue $15,000 for extending the water mains.

Bessemer, Ala.—The preliminary survey for the proposed new water works has begun.

Provo City, Utah—The city council contemplates the improvement of the water supply.

Ft. Snelling, Minn.—Bids will be asked for the erection of a pump house at the fort.

Lyons, N. Y.—The question of municipal ownership of the water works is being considered.

Elizabeth, N. C.—C. M. Ferebe has asked for a franchise to build a water works system.

Meridian, Miss.—Plans and specifications for the proposed water works are about completed.

Washington, S. D.—The question of issuing $2,500 bonds for an artesian well will be voted on.

Antioch, Cal.—The question of municipal ownership of the water works is being agitated.

New Hope, Pa.—G. C. Gohanear of Carlisle has made a proposition for establishing a water plant.

Milledgeville, Ga.—This city is dissatisfied with the service rendered by the water works company and is having the old cisterns cleaned and put in proper condition for use as a water supply in

case of fire. The city contemplates breaking the contract with the company Jan. 1.

Mankato, Minn.—A resolution is proposed which will require all water consumers to use meters.

Forest, O.—An ordinance has been passed to construct a water works system. Harry E. More, cy. clk.

Forest, O.—An ordinance has been passed for sinking a well, preparatory to building water works.

Perry, O. T.—This town voted Oct. 14 to issue bonds for the extension of the water works system.

Hannibal, Mo.—The water company contemplates making extensive improvements in its plant, involving an expenditure of $40,000.

Paducah, Ky.—The local water company contemplates building a water works plant at a cost of $100,000.

Lansing, Ia.—Plans for a reservoir, pumping station, etc., have been prepared by George C. Morgan of Chicago.

Brooklyn, N. Y.—The water commission has asked for an appropriation of $25,000 for the purchase of water meters.

Henry, Ill.—An ordinance was passed and approved Oct. 22 providing for the issue of bonds for the construction of a water works system. A. G. Humphrey, mayor; Fred S. Schafer, cy. clk.

Indianapolis, Ind.—Bids were received Oct. 17 as follows: Paving Mechanic-st., from South to Henry, with brick—American Construction Co., $2.38 a lin. ft.; Capital Paving and Construction Co., $2.39. Cement walks in Tenth-st:, from Holmes-ave. to Tibbs-ave.—Marion Caldwell, 62 cents; A. D. Bowen, 62½ cents; Henry Maag, 62½ cents; T. E. Kane, 63 cents. Brick paving, stone curb and cement walks in High-st., from McCarty to Prospect—J. K. Cooper, Poston blk., stratified curb, 5-ft. walk, $3.86 a lin. ft., with combined curb and gutter, $3.66; 3-ft. walk, 36 cents; sodding 12½ ft., 12 cents. American Construction Co., paving, $3.89; approach walks, 40 cents; sodding lawns, 10 cents. Capitol Paving and Construction Co., brick paving, 5-ft. walk, $4.25; 3-ft. approach walk, 45 cents; sodding, 15 cents.

New York City—Bids were submitted Oct. 22 for asphalt paving as follows: E. One Hundred and Forty-fifth-st., from Third-st. to St. Ann's-ave.—Barber Asphalt Paving Co., $1 a sq. yd. for asphalt; relaying old stone, 22 cents a sq. yd.; concrete base, $4.95 a cu. yd.; new curb, 80 cents a lin. ft.. Sicilian Asphalt Paving Co., asphalt, $1.20; old stone, 15 cents; concrete, $5; curb, 80 cents. Century Construction Co., asphalt, $1.36; old stone, 33 cents; concrete, $5; curb, 85 cents. Asphalt Construction Co., asphalt, $1.05; old stone, 30 cents; concrete, $5.50; curb, 80 cents. E. One Hundred and Fifty-eighth-st., from Third to Park-ave.—Continental Asphalt Paving Co., asphalt block, $1.79; concrete, $6.40; new curb, 95 cents; old curb, 25 cents. Hastings Pavement Co., asphalt blocks, $1.68; concrete, $6; new curb, $1; old curb, 25 cents. John L. Robertson, asphalt blocks, $1.89; concrete, $6; new curb, 90 cents; old curb, 28 cents. Paving various street intersections and Boston road, from Jefferson-place to Prospect-ave.—Asphalt, $1.25; concrete, $4.95; new curb, 85 cents; old curb, 18 cents. Century Construction Co., asphalt, $1.48; concrete, $5; new curb, 85 cents; old curb, 35 cents. Cauldwell-ave., from E. One Hundred and Sixty-first-st. to Westchester-ave.—Barber Asphalt Paving Co., asphalt blocks, $1.68; concrete, $6.40; old curb, 25 cents. John L. Robertson, asphalt blocks, $1.80; concrete, $6; old curb, 28 cents. Morris-ave., from E. One Hundred and Fifty-sixth to E. One Hundred and Sixty-fourth-st.—Continental Asphalt Paving Co., asphalt blocks, $1.68; concrete, $6.40. Hastings Pavement Co., asphalt blocks, $1.70; concrete, $6.40. John L. Robertson, asphalt blocks, $1.80; concrete, $6.50.

New Orleans, La.—An ordinance is being prepared providing for the extension of the water mains from Palmyra and Broad-st. to the House of Detention.

Bridgeport, Conn.—Rudolph Hering has been engaged to determine the condition of this city's reservoirs and to advise regarding the installation of a filter plant.

Mena, Ark.—The time for receiving bids for the proposed municipal water works system has not yet been decided upon. S. B. Robertson, cy. engr.; J. H. Hamilton, chmn. bd. water comrs.

Danville, Ky.—An ordinance has been passed providing for an election in November to vote on the issue of $20,000 bonds for the extension and improvement of the water works system.

Kansas City, Mo.—Ordinances have been approved providing for appropriations of $9,000 for improvements at Turkey Creek pumping station and $6,000 for repair of pipes around the station.

Fishkill, N. Y.—The construction of 4,100 ft. of 6-in. and 1,200 ft. of 4-in. water mains and an additional water supply is contemplated. E. H. Sheaff, supt. Fishkill and Matteawan Water Company.

Birmingham, Ala.—The Birmingham Water Works Company has agreed to establish a filtration plant at North Birmingham within twelve months and one in Spades Mountain for the Canaba supply within eighteen months.

The question of issuing bonds for constructing water works systems will be voted on at the following places: Harrodsburg, Ky., Nov. 4; San Bernardino, Cal., Nov. 4; Gonzales, Tex.; Shinnston, W. Va.

Toledo, O.—G. H. Benzenberg of Milwaukee, Allen Hazen of New York City and William G. Clark of this city have been appointed members of a pure water commission to secure a pure water supply for this city.

Crowley, La.—(Special.)—Armas Durio, supt. w. w. and elect. lights, says that this city is in the market for prices on about 15 mis. of 6 and 8 in. soil pipes for a water works system, fittings and fire hydrants.

The question of issuing bonds for building water works system has been favorably voted on at the following places: South McAlester, Ind. T.; Enid, Ok. T.; Tabor, Ia.; Bennett, Ia.; Ordway, Col., Sterling, Col.; Renton, Wash.

Toledo, O.—Willis F. Brown, 55 Law building, city, is making extensive surveys in connection with the special commission appointed to investigate and report on the best manner of securing a pure water supply for this city.

The construction of water works systems is contemplated at the following cities and towns: Clinton, Ind.; Columbina, Mo.; Somonauk, Ill.; Mallard, Ia.; Worthington, O.; Ottawa, O.; Newark, O.; Purcell, Ind. T.; Wilbur, Wash.; Oakland, Md.; Conrad, N. C.; Irvington, Ky.

Burlington, Ia.—The question of entering into a contract with the Citizens' Water Company, under terms set forth in an ordinance to improve, maintain and operate the water works system now in existence will be voted on Nov. 4. H. G. Marquardt, Mayor. F. P. Bulger, cy. clk.

St. Louis, Mo.—Mayor Wells, the members of the board of public improvements and a number of citizens visited St. Albans, 30 mls. west of this city, Oct. 23, to investigate a scheme of natural water filtration proposed by Bidwell Young, Newell C. Knight and Joseph C. Morris of Chicago. The B. P. I. passed a filtration ordinance Oct. 14. It provides for the installation of an experimental filtration plant at Bissells Point that will cost $30,000.

CONTRACTS TO BE LET.

Fremont, O.—Bids are asked until Nov. 7 for the installation of an air lift plant at the local pumping station. W. W. Trustees.

Ft. Columbia, Wash.—Sealed bids are asked until 10 a. m. Nov. 15 for grading roads and sidewalks. Geo. L. Goodale, Capt. & Q. M. U. S. A.

Louisville, Ky.—Sealed bids are asked until 12 m. Dec. 20 for the purchase of pumping engines. Chas. R. Long, prest. Louisville Water Company.

Ft. Columbia, Wash.—Sealed bids are asked until 10 a. m. Nov. 15 for constructing water and sewerage systems. Geo. L. Goodale, Capt. & Q. M. U. S. A.

Newport, R. I.—Bids are asked until Nov. 26 for a water supply and storage system at the U. S. Naval coal depot, Narragansett Bay. R. B. Bradford, ch. bureau equipment, navy Dept., Washington, D. C.

Washington, D. C.—Bids are asked until Nov. 8 for furnishing 1430 ft. of 8-in. pipe with valves, hydrants, etc., at the navy yard at Bremerton, Wash. M. T. Endicott, ch. bureau of yds and docks, Navy Dept.

Lawton, O. T.—Sealed bids are asked until 12 m. Nov. 5 for building a water works system, including the development of a supply, the erection of a storage reservoir, standpipe, pumping station and 9 mls. of system pipe distribution. Leslie P. Ross, Mayor. D. A. Jacobs, cy. clk.

CONTRACTS AWARDED.

Rapid City, S. D.—The contract for laying 600 ft. of pipe was awarded to Thomas J. Whelean.

Greensburg, Pa.—Contracts for constructing two water reservoirs have been awarded to H. F. Stark.

Lidgerwood, N. D.—The contract for building water works has been awarded to Gray & Co. of Minneapolis.

Golden, Col.—The contract for building a water works system was awarded to M. B. McDonald for $95,000.

Anderson, Ind.—Isaac E. May was awarded the contract for furnishing water mains for the Maplewood cemetery.

Kewanee, Ill.—The contract for laying water mains on the Vine-st. district was awarded to J. M. Healy of Chicago.

Cass Lake, Minn.—The contract for laying 3,500 feet of 6 to 8-in. water pipe has been awarded to P. G. Pastout & Martin of Two Harbors.

Tarrytown, N. Y.—The contract for the Pocantico river pumping station was warded Oct. 22 to Moffatt, Hewitt & Morris of New York City.

York, Pa.—The York Water Company has awarded a contract for supplying all materials for building the new water works plant to the National Building and Supply Company.

Ballard, Wash.—The contract for laying the water mains for the new water works system was awarded to the Pacific Coast Pipe Company for about $10,000.

Detroit, Mich.—Bids for constructing the new caisson at the water works were received as follows: Riter-Conley Manufacturing Company, $2,575; Stephen Pratt, $2,670; East End Boiler Works, $3,162; Whitehead & Kales, $3,675.

Paulsboro, N. J.—Contracts for water works supplies, machinery, etc., were awarded Oct. 11 as follows: 330 tons of 8, 6 and 4-in. pipe, $32, specials 3 cts. per lb., $11,160; also valves and valve boxes, $322.75; fire hydrants. J. Thompson & Co., $938.90; pipe laying. W. H. Boardman, $3,100; standpipe, etc. A. H. Haig, $4,900; pumping machinery and plant, Otto Gas Engine Works, $2,440.

BRIDGES.

Paoli, Ind.—Sealed bids are asked until Nov. 6 for building two bridges. Co. comrs.

New Castle, Ind.—Bids are asked until Nov. 7 for building six small steel bridges. Edwin Hall, comr. Henry co.

Beach Creek, Pa.—The commissioners of Center and Clinton counties contemplate building an iron bridge at this place.

Erie, Ill.—A bridge across Rock river, between this town and Kempsterville is contemplated according to press reports.

Arkadelphia, Ark.—A steel bridge across the Ouachita river, between this place and Daleyville, has been decided upon.

Carrollton, Mo.—Sealed bids are asked until 2 p. m., Nov. 7, for building wood or steel bridges. Silas Ballard, bridge comr.

New Castle, Pa.—Estimates will be prepared for building a viaduct from E. Long-ave. to N. Liberty-st., a distance of 3,300 ft.

Jasper, Ala.—Bids are asked until Nov. 5 for building a steel bridge over Lone creek at Cordova. J. W. Shepherd, judge of probate.

Chehalis, Wash.—Bids are asked until Nov. 6 for building a steel and combination bridge over Cowlitz river at Mayfield. Co. audt.

Hamilton, O.—The question of erecting a bridge on the county line in Fairfield twp. is being considered by the county commissioners.

Traverse City, Mich.—Plans for building a combination concrete and steel bridge will be prepared by Bloomshield & McCloy of Bay City.

Big Timber, Mont.—Bids are asked until Dec. 1 for building a bridge across Sweet Grass river at Mydland Crossing. J. H. Moore, co. clk.

Washington, Ind.—Sealed bids are asked until Nov. 10 for the construction of a bridge on concrete abutments over ...te river. Co. Comrs.

Allegany, N. Y.—The question of appropriating $12,000 for building a new bridge across the Allegany river will be voted on in November.

Kansas City, Mo.—The board of public works approved, Oct. 19, the plans of the cy. engr. for a concrete bridge over Brush creek on the Wornall road.

Marshalltown, Ia.—An ordinance has been passed providing for a viaduct over the Iowa Central, Northwestern & Great Lake tracks at Center-st.

Scranton, Pa.—The residents of the Tenth ward have petitioned for the construction of bridges over Roaring brook at the end of Ash and Myrtle-sts.

Shreveport, La.—Bids are asked until Nov. 13 for building a steel bridge over Dooley Bayou in Caddo Parish. P. P. Keith, prest.; A. L. Duringer, clk.

Joplin, Mo.—The road and bridge commissioner was directed Oct. 24 to advertise for bids for building two bridges, one over Center creek and one over Turkey creek.

Huntsville, Ala.—The business men are taking action toward securing the construction of a railway and wagon bridge across the Tennessee river near Whitesburg.

Grand Rapids, Mich.—The contract for the construction of the piers and abutments for the new bridge at Wealthy-ave. was awarded Oct. 24 to James Higgins for $26,840.

Chillicothe, O.—Bids are asked until Nov. 10 for constructing the substructure of a bridge over Yellow Bend creek, on Franklin pike, at Yellow Bend. Harry S. Adams, co. audt.

Indianapolis, Ind.—Sealed bids are asked until 10 a. m. Nov. 6 for building a bridge over Little White Lick creek on the road running from Bridgeport. John McGregor, chmn. co. comrs.

Paulding, O.—Sealed bids are asked until 12 m. Nov. 14 for building three high truss skew bridges. J. B. Weible, chmn. co. comrs.; Allen Bybee, co. audt.

Hatfield, Mass.—This town voted Oct. 15 to expend $3,000 for a fill and bridge near North Hatfield. The work will cost about $5,000 and the electric railroad company has offered the town $1,000 for its share of the work.

Little Falls, Mont.—The question of issuing $5,000 bonds for completing the wagon bridge now under construction across the Mississippi river at Broadway will be voted on in November. Chas. E. Vasaly, mayor; Fred Cary, cy. clk.

St. Paul, Minn.—The board of aldermen has directed that plans be prepared for the extension of the Third-st. bridge to Hoffman-ave. The citizens are agitating the question of building another bridge across the Mississippi to replace the present Broadway structure.

Madison, N. C.—Bids will probably be asked soon for the superstructure work of the proposed bridge near Spray. The bridge, which will be built by the county and by private subscription, will be of steel on stone foundation and will cost $5,000. Address J. S. McAlister, Spray, N. C.

Buffalo, N. Y.—(Special.)—The board of public works has been directed to readvertise for bids for the abutments and wing walls for the Springer-ave. bridge over the Scajaquada creek. The new bids will be for cement and expanded metal abutments and wing walls. The bids received some time ago for this work were rejected because they exceeded the appropriation.

LIGHT, HEAT AND POWER.

Hubbard, O.—The question of electric lights is being agitated.

Dryden, N. Y.—The estimated cost of an electric light plant for this place is $6,650.

North Amherst, O.—This town voted to issue $10,000 for establishing an electric light plant.

Alliance, O.—A 10-year contract has been awarded the Alliance Gas and Electric Company for lighting this city.

Oneida, N. Y.—Bids will be received Nov. 11 for lighting this city with electricity for 5 years.

Columbus, Ga.—A charter has been granted the Coweta Power Company for developing the Chattahoochee river.

South Norwalk, Conn.—The council committee has recommended the construction of an electric light plant.

Marion, Ia.—The question of granting a franchise for installing and operating a gas plant is being considered.

Rome, N. Y.—Bids are asked until about Jan. 15 for constructing an electric light plant. J. D. Hanks, mayor.

La Salle, N. Y.—(Special.)—The Ontario Transmission & Power Company has applied to the town board for a franchise.

Berwyn, Ill.—The village trustees are investigating the advisability of installing an electric light plant.

New Castle, Pa.—A resolution was passed Oct. 21 to renew the contract for lighting this city for $33 per light.

De Smet, S. D.—The contract for a gas lighting plant was awarded the Practical Gas Company of Chicago for about $7,000.

Montclair, Colo.—An ordinance was introduced Oct. 9 granting a franchise for the installation of an arc light system.

Marksville, Ia.—The contract for an electric light plant has been awarded the

Marksville Electric Light and Power Company.

Reedsburg, Wis.—Sealed bids are asked until Nov. 5 for furnishing 25 enclosed arc lamps and transformers. A. H. Clark, cy. clk.

Erie, Pa.—A resolution passed the common branch of councils Oct. 20 to ask for bids for lighting this city for one to five years.

Winona, Minn.—Bids are asked until Dec. 1 for a lighting plant of 250 arc and 350 incandescent light capacity. G. P. Coleman, cy. engr.

Madison, Me.—A committee has been appointed, according to press reports, to investigate the cost of constructing an electric light plant.

Canandaigua, N. Y.—The village board has formally agreed to contract with the Ontario Light and Traction Company for a renewal of street lighting.

Manilla, Ia.—A contract has been granted A. S. Avery and C. R. Smith for constructing a gasoline gas lighting plant of 1900 lights capacity.

Akron, O.—Bids are asked until Nov. 6 for lighting this city with 800 or more gas lamps of 50 c. p. each for five years. Charles H. Isbell, cy. clk.

Jamestown, N. Y.—The bd. of pub. wks. has recommended the enlargement and extension of the city electric light plant at a total cost of $40,000.

Stillwater, Minn.—The state bd. of control will construct an electric light plant at the state prison in this place for lighting that institution.

Akron, O.—An ordinance passed first reading Oct. 20 providing for the issue of $8,000 bonds for establishing a vapor light plant. Charles H. Isbell, clk.

West Seneca, N. Y.—(Special.)—The town board has directed that plans and specifications for electric lighting be prepared and bids asked for construction.

Mankato, Minn.—Sealed bids are asked until 3 p. m. Nov. 7 for lighting the streets with electricity, gas, gasoline or oil lights. D. V. Williams, cy. recorder.

McKeesport, Pa.—A resolution has been passed authorizing the city comptroller to secure bids for furnishing the city with electric lights, after Dec. 15, for one year.

Santa Fe, N. M.—A franchise has been granted the Santa Fe Power and Light Company to erect a large power plant in the Upper Pecos river to furnish this city with light and power.

Bath, N. Y.—A five-year contract for lighting the streets was awarded the Bath Electric Light Company Oct. 6 at $5,000 per year, which is the same price paid under the old contract.

Superior, Wis.—Bids will be received until Nov. 18 for the construction, maintenance and operation of a plant for distributing electric currents throughout this city. John A. Hobe, cy. clk.

Sycamore, Ill.—The board of aldermen elected recently to fill the places of those who resigned favor electric lights. The board consists of E. C. Chandler, Henry Stark, Frank Pattern and John Quist.

Niagara, N. Y.—(Special.)—A franchise has been granted the Ontario Transmission and Power Company to conduct business in this city. The Niagara Falls Hydraulic Power and Manufacturing Company has begun the erection of a new power house.

Charter Oak, Ia.—A contract has been awarded the Harrison Lighting Company for a gasoline lighting plant for $6,000. The plant will consist of 19 street lamps, over 3 mls. of lighting mains and will be in operation by Dec. 1.

Superior, Wis.—A resolution was approved by C. N. O'Hare, mayor, Oct. 16, directing the city clerk to ask for bids for granting a franchise for the erection and maintenance of a plant for distributing electricity. J. A. Hoke, cy. clk.

Kansas City, Mo.—A resolution was adopted Oct. 20 directing the bd. of pub. wks. to enter into a contract with the Kansas City Electric Light Company to supply this city with arc lights at $65 per light per year. The present cost is $87.50 a light.

Marshall, Ill.—Bids will be received until Sept. 3 for the purchase of the Marshall electric light plant. The purchaser will be given an exclusive franchise for 15 years and a contract to furnish this city 43 or more arc lights for 10 years. Geo. O. Baird, cy. clk.

Newport, Ky.—A resolution was passed Oct. 9 authorizing the city clerk to ask for bids for granting a franchise for furnishing this city with electricity for light, heat and power for 15 years. Also for a franchise for furnishing gas to the city and inhabitants for 15 years.

Pana, Ill.—An injunction was served against the city council Oct. 13 restraining it from granting a franchise for lighting this city with arc lights. The petition states that the city is already taxed beyond the constitutional limit, and the building of a new plant would largely increase the taxes.

St. Paul, Minn.—Efforts will be made to include in the street lighting specifications under which the contract will be let for 1903, provision for competition among the different kinds of lighting. Bids will be asked for lighting with arc, incandescent gas, incandescent gasoline and acetylene. The specifications will be completed in November.

Ithaca, N. Y.—The contract for constructing a dam in Six Mile creek has been awarded to Tucker & Vinton of New York City. The dam, which is a semi-circular steel concrete structure 93 feet high, is an important piece of work, inasmuch as a large body of water, which will be formed by the closing of the gorge, will be directly above this city.

New York City—Tucker & Vinton, 156 Fifth-ave., have been awarded the contract for the installation of their steel concrete vault light throughout the stations of the rapid transit subway. Also the contract for the concrete steel arches and finished concrete work throughout the main power house for the Rapid Transit Construction Company at Eleventh-ave. and Fifty-eighth-st. John Pierce is the general contractor.

Constantine, Mich.—The village council annulled Oct. 3 the contract with the Constantine Electric Company, by which the village was to pay $1,500 per year for

a term of five years for street lighting, and made a new contract to take effect Feb. 1, 1903, at the rate of $2,200 per year for a term of seven and one-half years. Under the new contract the village will be lighted with 5 arc lamps, 4 incandescent lamps of 100 c. p. and 108 lamps of 32 c. p.

Michigan City, Ind.—Bids were submitted Oct. 20 for lighting this city for 10 years as follows: Fred A. Gale—All-night lights, $75 per lamp per year; on Philadelphia moonlight schedule, 2,200 hours, $65 per lamp per year. Michigan City Electric Company—Philadelphia moonlight schedule, $77 per lamp; western moonlight schedule, $78; central moonlight schedule, $78; standard moonlight schedule, $76; lights burning from dusk until 12 o'clock, $74. Action on these bids was deferred.

St. Louis, Mo.—An electric light bill was introduced in council Oct. 10, providing for the establishment of a $1,000,000 municipal electric lighting plant, to be completed in 1909, when the present contract for street lighting expires. A franchise has been granted the Missouri & Meramec Water Company to build an artificial canal connecting the Missouri and Meramec rivers and extending from Centaur to a point near Meramec highlands, to supply power to a large number of manufacturing establishments which will be erected along this route. The canal will cost about $5,000,000.

GARBAGE DISPOSAL, STREET CLEANING AND SPRINKLING.

North Adams, Mass.—The contract for the collection of garbage for five years was awarded to Wm. A. Ballou of this city at $2,500 per annum.

Utica, N. Y.—The contract for the removal of ashes and street sweeping was awarded to Wm. Pritchard, the present contractor, at $37,685 for five years.

Milwaukee, Wis.—The American Underwriting Company of Boston is reported as having proposed to purchase the garbage crematory of this city and operate it without cost to the city, the city to pay for collection and transportation of garbage.

Oakland, Cal.—An ordinance is pending which provides for the purchase of the garbage crematory plant from the Pacific Odorless Incinerator Company for $35,000, the city to run the plant. The city council has also authorized an expenditure of $45,000 for sprinkling the streets and $12,000 for cleaning gutters and portions of streets.

Chicago, Ill.—F. W. Solon, asst. supt. of sts., says that unless some new method of garbage disposal is adopted by next spring this city will face one of the most serious problems that ever confronted it. The eleven garbage dumps now being used will all be full by next March, and after that the city will have but two available places to put to such use.

Atlanta, Ga.—Sealed bids are asked until 12 m. Dec. 1 (extension of time) for the collection and disposal of all the garbage night soil and cleaning the streets of this city for five years. Separate bids are desired for the collection and disposal of garbage; for the collection and disposal of night soil; for cleaning the streets. Sealed bids are also invited for the cremation or incineration of all the garbage, night soil and refuse of the city. Dr. E. H. Richardson, secy. bd. of health.

Meadville, Pa.—Bids for the construction of a garbage crematory were received Oct. 15 as follows: International Engineering Corporation, Bridgeport, Conn., a two-crib Smith Improved Garbage Crematory, 25 tons daily, steel stack, $5,570; brick stack, $5,250; wood building to house crematory, $2,400; brick building, $4,500. Dixon Garbage Crematory Company, Toledo, O., double furnace of 25 tons, $5,250; brick buildings, $3,750; wood building, with iron siding, 25 per cent. less. Davis Garbage Furnace Company, Lancaster, Pa., building two furnaces, brick stack, $7,400; steel stack, $6,900; one 25-ton furnace, brick stack, $5,100; steel stack, $4,650; building for either proposed, $4,200.

PARKS.

Troy, O.—This town voted to purchase a thirteen-acre park.

Waco, Tex.—A park containing 100 acres and with a 40-acre lake, will be opened to the public soon.

Sun Prairie, Wis.—This town has been presented with nine acres of land for a park by Col. W. H. Angell.

Grand Rapids, Mich.—The purchase of 48 acres of land for a new park is contemplated by the council.

Chicago, Ill.—The West Chicago Park Commissioners have begun condemnation proceedings to secure sites for four small parks.

Brantford, Ont.—A tract of land known as Agricultural Park has been donated to this city by Charles Cockshutt for a public park.

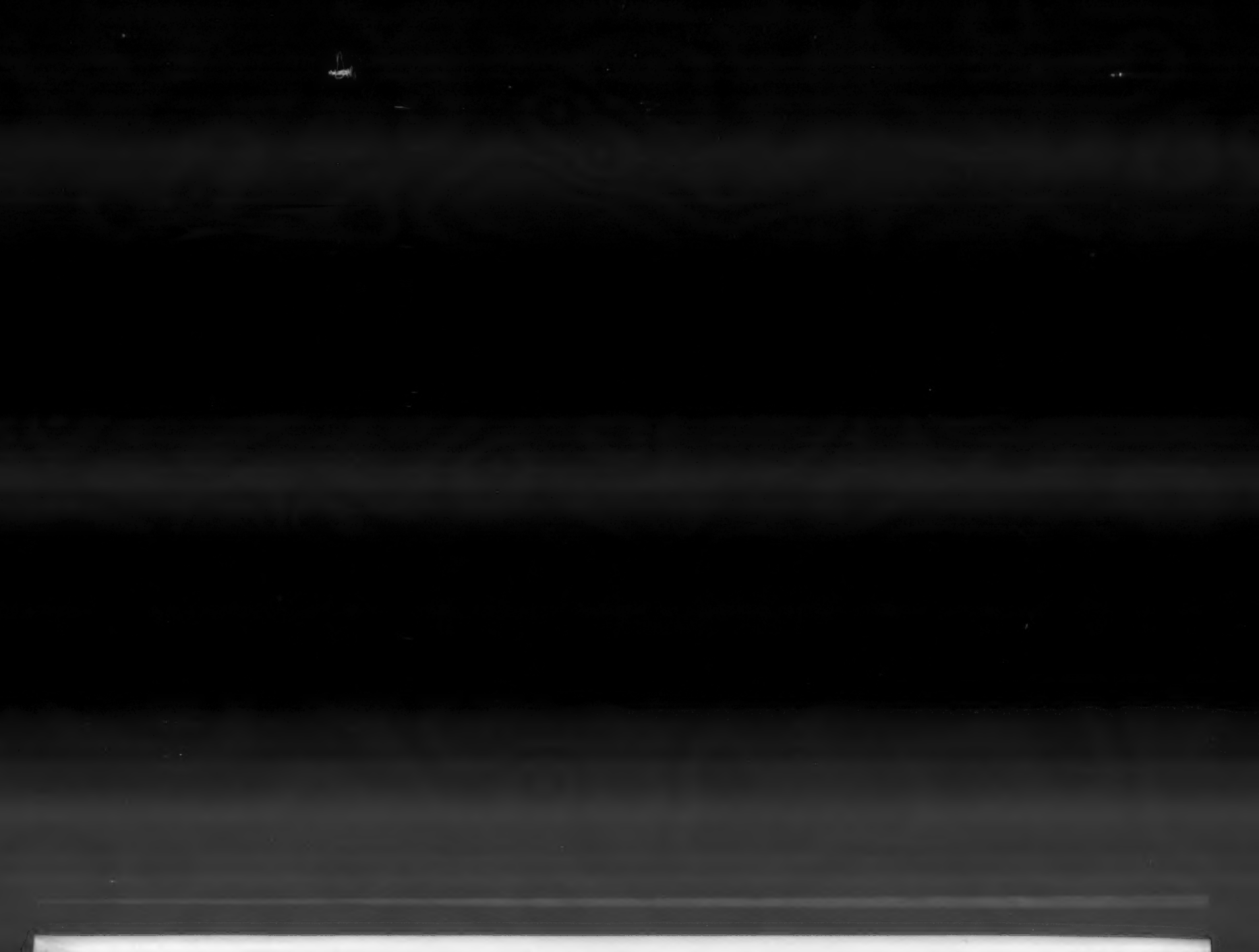
Rochester, Minn.—A resolution has been adopted authorizing the purchase of land for the proposed city park. It will be known as Mayo park. Cy. Clk. Kalb.

Kalamazoo, Mich.—A tract of 100 acres has been presented to this city for a public park by John W. Jones, with the provision that the city expend $5,000 for five years improving it.

FIRE APPARATUS.

Glassport, Pa.—The question of purchasing fire equipment will be voted on.

South Orange, N. J.—The fire department is endeavoring to induce the twp. committee to secure a fire alarm system.

Tacoma, Wash.—The commissioner of public works was authorized, Oct. 15 to ask for bids for the purchase of 1,500 ft. of fire hose.

Saginaw, Mich.—Sealed bids are asked until 4:30 p. m., Nov. 7 for the purchase of about 900 ft. of 2½-in. fire hose, complete with couplings. Arthur F. Lewis, comptroller.